Bulletin British Museum (Natural History)

Entomology Series

VOLUME 59 NUMBER 1 28 JUNE 1990

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World List abbreviation: *Bull. Br. Mus. nat. Hist.* (Ent.)

© British Museum (Natural History), 1990

ISBN 0 565 06039 2
ISSN 0524 – 6431

Entomology Series
Vol 59, No. 1, pp. 1 – 115

British Museum (Natural History)
Cromwell Road
London SW7 5BD

Issued 28 June 1990

Typeset by Computer Typesetting Services, Redhill, Surrey
Printed in Great Britain by Henry Ling Ltd, Dorchester, Dorset

Bull. Br. Mus. nat. Hist. (Ent.) **59**(1): 1–35 Issued 28 June 1990

The songs of the western European bush-crickets of the genus *Platycleis* in relation to their taxonomy (Orthoptera: Tettigoniidae)

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SYNOPSIS. The calling songs of 11 species of the decticine genus *Platycleis* s.l. (including *Sepiana*, *Tessellana* and *Montana*) are described and fully illustrated with oscillograms at three or four different speeds. For each species a list is provided of references to any past work published on the songs, classified according to the kind of information given. Notes on recognition, using both morphology and song, are given for each species, and two identification keys are provided, one based on morphology and the other on song. The value of the song as a taxonomic character is discussed.

INTRODUCTION

The decticine bush-crickets, of which *Platycleis* is one of the most familiar Old World genera, are a group of usually cryptically coloured insects living on or near the ground, or occasionally in shrubs. The group includes over 160 European species, several of which are pests in parts of their range.

Platycleis, in the broad sense used here, is a widespread Palaearctic genus including about 100 species, usually grey-brown or yellow-brown in colour and living in open, mainly dry habitats at a wide range of altitudes. Eighteen species have been recorded from western Europe, of which at least two, *albopunctata* and *intermedia*, become pests when they occur in sufficient numbers, causing damage to cereal grasses and other crops.

As in most Tettigoniidae, the males of all species of *Platycleis* stridulate by rubbing a scraper on the right fore wing against a file on the underside of the left fore wing; the females are silent. The main function of the songs is to attract conspecific females and the differences between the songs provide a mate recognition system, as in

Table 1 Data for the field recordings of songs of *Platycleis* used for oscillograms reproduced in this study. Recordists' names are abbreviated as follows: DRR = D. R. Ragge; WJR = W. J. Reynolds; MJS = M. J. Samways. Further details are given on pp. 2–3.

Species	Locality	Date recorded	Recordist	Shade air temperature	Recording No.
albopunctata	FRANCE: Vaucluse, Mont Ventoux, road from Bédoin, 1100 m	12.viii.1977	DRR	20°C	234/4
	ITALY: Abruzzi, Gran Sasso d'Italia, 2 km E. of Passo delle Capannelle, 1500 m	2.ix.1985	DRR	21°C	605/1
sabulosa	FRANCE: Pyrénées-Orientales, St Cyprien	31.viii.1974	DRR	24°C	137/2
affinis	FRANCE: Vaucluse, near Carpentras, Bédoin	13.viii.1977	DRR	22°C	235/1
romana	ITALY: Lazio, near Rome, SE. side of Colli Albani	8.ix.1985	DRR	26°C	60e/9
	ITALY: Calabria, Sila Mountains, near Bocca di Piazza	20.ix.1988	DRR	16°C	725/3
falx	FRANCE: Hérault, Agde, Pic St Loup	3.viii.1972	MJS	19°C	243/8
	FRANCE: Pyrénées-Orientales, St Cyprien	31.viii.1974	DRR	24°C	137/1
	FRANCE: Hérault, near Montpellier, bank of Canal du Rhône	27.viii.1986	WJR	25°C	640/1

the true crickets and gomphocerine grasshoppers. The songs of the western European *Platycleis* provide an excellent means of recognizing the species in the field; this is especially useful as several of the species are extremely difficult to identify from their morphology. Although the songs of several species have been used as the basis of a number of behavioural studies (e.g. Samways, 1976*a*, 1976*b*, 1976*d*, 1977; Samways & Broughton, 1976; Latimer, 1981*a*, 1981*b*), and are included in the excellent work by Heller (1988) on the bioacoustics of European Tettigoniidae in general, there has been no comprehensive account of the songs of the species of *Platycleis* in relation to their taxonomy and identification. The main aim of the present paper is to provide such an account for the western European species. The paper is primarily concerned with Europe west of, and including, Germany, Austria and Italy, but most of the species treated also occur commonly in eastern Europe and some of them extend their ranges into Asia.

The only western European species not included in this study are very local forms, often of doubtful status, in which the song is unknown to me. For each of the 11 species included a list is provided of references to any previously published information on the song, classified according to the kind of information published.

ABBREVIATIONS OF DEPOSITORIES

BMNH British Museum (Natural History), London
MNHN Muséum National d'Histoire Naturelle, Paris
MNHU Museum für Naturkunde der Humboldt-Universität, Berlin
NM Naturhistorisches Museum, Vienna

METHODS

RECORDING AND ANALYSING THE SONGS

With one exception, all the field recordings of the songs used in this study were made with a Uher 4000, 4200, 4200 IC or 4200 Monitor tape recorder

Table 2 Data for the indoor recordings of songs of *Platycleis* used for oscillograms reproduced in this study. Recordists' names are abbreviated as in Table 1. Further details are given on pp. 3–4.

Species	Locality	Date collected	Date recorded	Recordist	Air temperature	Recording No.
albopunctata	ENGLAND: Sussex, Eastbourne, Cow Gap	11.vii.1976	13.vii.1976	DRR & WJR	27°C	166
	WALES: West Glamorgan, Gower, Nicholaston Burrows	3.ix.1976	6.ix.1976	DRR	24°C	173
	JERSEY: Quennevais	16.vii.1977	23.viii.1977	WJR	30°C	214
	SPAIN: Madrid, Sierra de Guadarrama, Puerto de Morcuera, 1796 m	15.ix.1982	28.ix.1982	WJR	26°C	467
sabulosa	SPAIN: Madrid, Manzanares	13.ix.1982	1.x.1982	WJR	22°C	472
	SPAIN: Toledo, near Oropesa, Las Ventas de San Julian	4.viii.1983	5.viii.1983	DRR	23°C	507/7
affinis	FRANCE: Landes, 3 km NW. of Morcenx	15.ix.1976	15.ix.1976	WJR	18°C	180/10
	SPAIN: Zamora, Benavente	21.viii.1986	21.viii.1986	WJR	27°C	586/4
intermedia	SPAIN: Granada, La Rábita	24.vi.1984	30.vii.1984	DRR	23°C	536
sepium	YUGOSLAVIA: Croatia, 2 km SE. of Rijeka	16.viii.1985	4.ix.1985	WJR	25°C	582
tessellata	FRANCE: Vaucluse, Mont Ventoux, near Les Bruns	11.viii.1977	11.viii.1977	DRR	24°C	233/5
	SPAIN: Madrid, Manzanares	13.ix.1982	30.ix.1982	WJR	22°C	473
veyseli	AUSTRIA: Burgenland, Neusiedler See, near Illmitz	18.viii.1973	19.viii.1973	DRR	26°C	102/2
montana	Same locality	24.viii.1973	24.viii.1973	DRR	25°C	104/1
	Same locality	24.viii.1973	26.viii.1973	DRR	25°C	104/2
stricta	ITALY: Abruzzi, Gran Sasso d'Italia, Valley N. of Monte della Scindarella, 1800 m	1.ix.1985	1.ix.1985	DRR	25°C	604/5

and AKG D202 microphone; the exception, recording 243/8, was made with an Akai X-IV tape recorder and Akai ADM-4 microphone. The tape speed was always 19 cm/s. All the recordings were made while the insects were in full sunshine except for recordings 640/1 and 725/3, which were made during hazy sunshine, and recording 243/8, which was made at night in complete darkness. Recording 243/8 was made from a caged insect (collected 8 days previously) in the open air; all the other recordings were made from free insects (captured immediately after the recording) that were approached stealthily so that the microphone could be held (or rested on the ground) close to them without causing any disturbance.

The indoor recordings were made in a suitable quiet room near the original locality using a Uher tape recorder and AKG microphone of the type mentioned above (tape speed: 19 cm/s), or in the BMNH Acoustic Laboratory using a Kudelski Nagra IV tape recorder and Sennheiser MKH 405 microphone (tape speed: 19, 38 or 76 cm/s).

Recordings 507/7 and 586/4 were made in complete darkness, recordings 102/2, 233/5, 536 and 582 were made in dim light, and the remaining recordings were made with a bench lamp next to the cage to provide light and radiant heat.

Further details are given in Tables 1 and 2 for the recordings used for the oscillograms reproduced in Figs 36–125. However, the song descriptions given for each species are in most cases based on many more recordings of numerous songs, all of which were analysed oscillographically. The oscillograms reproduced in the figures were chosen as being typical of the species concerned and, in some cases, showing the extent of intraspecific variation.

All the oscillograms were made from recorded songs with a Mingograf 34T ink-jet recorder.

SONG TERMINOLOGY

The bio-acoustic terms used are defined as follows.

Calling song. The song produced by an isolated male.

Syllable. The sound produced by one complete opening and closing movement of the fore wings (Fig. 1). The songs of a number of European decticine bush-crickets include two contrasting kinds of syllable, differing markedly in duration. Following Samways (1976a) I have termed the longer, more normal ones *macrosyllables* and the shorter ones, usually lasting less than 10 ms, *microsyllables* (Fig. 1).

Diplosyllable. A syllable in which sound is produced by both the opening and closing movements of the fore wings (Fig. 1).

Hemisyllable. The sound produced by one unidirectional movement (opening or closing) of the fore wings (Fig. 1 and see below).

Echeme. A first-order assemblage of syllables (Fig. 1 and see below).

Echeme-sequence. A first-order assemblage of echemes.

For convenience in describing the songs of *Platycleis* the definition of the term hemisyllable given above is slightly looser than that given by Broughton (1964: 853). Broughton took the view that this term should be used only in referring to each of the two components of a diplosyllable, i.e. when sound is produced by both the opening and closing movements of the fore wings; he suggested the term 'haplosyllable' for a syllable in which sound is produced by only one of the two movements of the fore wings (usually the closing stroke). In several species of *Platycleis* the opening strokes of the fore wings sometimes produce sound but sometimes do not; using Broughton's definition the sounds produced by the closing strokes would sometimes be hemisyllables and sometimes haplosyllables, and description would become too cumbersome. The definition of hemisyllable given above removes this difficulty. In songs containing both micro- and macrosyllables I have further simplified the terminology by sometimes referring to 'closing macrosyllables' when 'closing macrohemisyllables' would be strictly more accurate.

The simple definition of the term echeme given above gives rise to some difficulty in two species of *Platycleis*: *stricta* and *montana*. The song of *stricta* includes a dense series of equally spaced syllables in which every third one is louder than the rest (Figs 122, 124). It could be argued that these units of one louder and two softer syllables (or even just the two softer ones) are first-order assemblages of syllables and that they should therefore be termed echemes, but I have found it less cumbersome in the present study to regard the complete series of syllables as a single echeme. In effect, this interpretation requires the presence of distinct pauses as a criterion for separating groups of syllables into echemes, rather than the mere repetition of a pattern based solely on changes in amplitude. I have used the same criterion in treating the dense series of syllables produced by *montana* as echemes, although the syllables are alternately softer and louder (Figs 117–120).

PRESENTATION

As the main purpose of this paper is to give information on songs, I have not included either a full synonymy or a formal morphological diagnosis in the account of each species. I have, however, listed references to all past descriptive accounts of the songs (of any significance), classified according to whether they include oscillograms (including sound-level tracings), diagrams (i.e. hand-drawn representations of the songs), sonagrams (audiospectrograms), frequency information, musical notation, or verbal description without any of these additions; any commercially available disc or cassette recordings of the songs are also listed. These references are not intended to be exhaustive – there are many brief statements about the songs, especially in the earlier literature, that do not warrant inclusion; my aim has been to list all sources that the reader might find useful to refer to for additional or confirmatory information on the songs. The only references I have included to works published before the

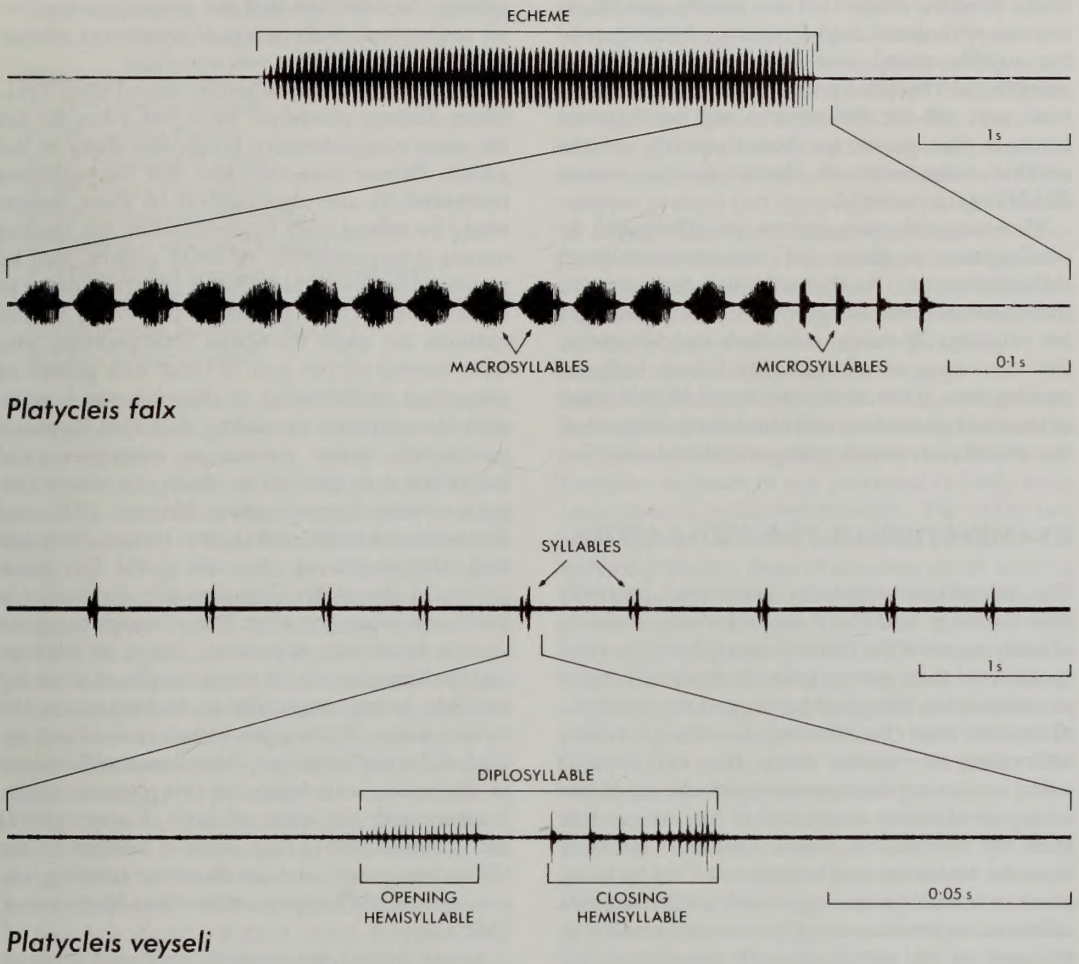


Fig. 1 Oscillograms of the male calling songs of two species of *Platycleis*, showing the terminology used in this paper.

present century are to two papers by Yersin (1854*b*, 1857), the first of which gives a short but admirable account of the songs of 38 European species of Orthoptera (including two of *Platycleis*), in which he attempted, with some success, to represent them in terms of musical notation.

Notes are given for each species on recognition by both morphology and song, and these are followed by a more detailed descriptive account of the calling song. The songs of Tettigoniidae, unlike those of most gomphocerine grasshoppers, are often produced after dark as well as during the day, and as a result these insects sing over a very wide range of body temperatures. During low night-time temperatures the muscles of the stridulatory organ move much more slowly than in sunny daytime weather and, although the overall rhythmic pattern of the song is usually maintained, the repetition rates for syllables and echemes become much lower (cf. Figs 90, 92). In addition, the songs of the small species of *Platycleis* included in this study (*tessellata, veyseli, montana* and *stricta*) are too quiet to be heard by the human ear in most outdoor situations. The song descriptions given in this paper for each of the larger species refer to songs produced in warm, sunny, daytime weather; those given for the four small species refer to songs produced by captive males in quiet, warm, indoor conditions, especially at night.

Tettigoniid songs usually contain a large element of ultrasound; in many species most of the sound energy is ultrasonic and a few tettigoniid songs are entirely ultrasonic. Even the audible frequencies tend to be towards the higher end of the audio range and some human ears with poor high-frequency reception are quite unable to detect them. All the species of *Platycleis* included in this

study produce songs that are clearly audible to anyone with good high-frequency hearing, and the audible sound contains all the information (mainly the rhythmic pattern) needed for taxonomic use. All the descriptions and oscillograms given in this paper are based entirely on the audible component of the songs (i.e. below 20 kHz in frequency).

The songs of each species are illustrated by oscillograms at three (in one instance four) different speeds. As the scale lines indicate, the three speeds normally given are (after reduction for printing) 20 mm/s, 160 mm/s and 640 mm/s. For two songs of *albopunctata* I have included oscillograms at the additional speed of 2560 mm/s in order to show the individual tooth-impacts of the stridulatory organ with particular clarity.

EXAMINATION OF THE TITILLATORS

The sclerotized epiphallic structures generally referred to as 'titillators' are frequently useful in identifying male decticine bush-crickets. In dried specimens they are usually concealed (except sometimes for the apical parts) and the tip of the abdomen must be thoroughly relaxed before attempting to examine them; they can then be eased into an exposed position with the aid of fine forceps and either examined *in situ* or cut free from the surrounding tisses. Titillators removed from the abdomen may be preserved dry by being stuck to a small piece of card with a water-soluble adhesive, or immersed in glycerine in a small vial; the card or vial should then be attached to the same pin as the main body of the specimen.

CLASSIFICATION AND NOMENCLATURE

The taxonomy of the decticine bush-crickets belonging to *Platycleis* and related genera still defies a satisfactory solution after two centuries of study by many European workers. For the period 1852 to 1927 the genera *Platycleis* s.l. and *Metrioptera* Wesmael s.l. were united in a single genus, the name *Platycleis* being used until Caudell's work of 1908 and the earlier name *Metrioptera* being used, correctly, from that time onwards. Then Ramme (1927) proposed that *Platycleis* should be given separate generic status for its type species *grisea* and eight closely related fully winged species, leaving the name *Metrioptera* for the remaining very mixed assemblage of species; he admitted that the generic assignment of such small fully winged species as *stricta, montana* and *tessellata* was uncertain.

This unsatisfactory situation lasted until 1941, when Zeuner produced what has been by far the most comprehensive taxonomic study of the group. Zeuner took the view that the problems presented by the classification of these insects could be solved only by distributing the species among a large number of small genera, and he proposed no fewer than 13 new genera in order to achieve this. These proposals proved to be too extreme for most European orthopterists, who have treated all but four of these new genera as subgenera of *Platycleis* or *Metrioptera*. I agree with the currently prevailing view that Zeuner's genera are better treated as subgenera, and am inclined to give *all* of them this status (together with *Eumetrioptera* Miram, 1935 and *Zeuneriana* Ramme, 1951), thus leaving *Platycleis* and *Metrioptera* as the only valid European genera in the group. This bipartite division is in itself unsatisfactory, since even these two genera cannot be clearly separated, but it is perhaps justified on grounds of convenience, at least for the time being, especially as *Metrioptera* is the earlier name. Taking this broad view I have included Zeuner's *Sepiana*, *Tessellana* and *Montana* in *Platycleis*, and hence in this present study. I agree with the view of both Zeuner (1941) and Ramme (1951) that *Sepiana* belongs to the '*Platycleis*-group', and am therefore treating it as a subgenus of *Platycleis* rather than *Metrioptera*. (See also p. 8.)

Koçak (1984) has recently proposed replacement names for *Locusta tessellata* Charpentier and *L. vittata* Charpentier, both of which he believed to be junior primary homonyms. He was, however, wrong in thinking that *L. tessellata* Charpentier was preoccupied by '*Locusta tessellata* Drury', perhaps basing his belief on the erroneous statements by both Walker (1869: 171) and Kirby (1906: 144) that Drury's *tessellata* was originally described in *Locusta*. In fact Drury (1773: [92]) used the original combination *Gryllus (Acheta) tessellata* (not, as recently stated by Kruseman (1989: xi), '*Gryllus (Locusta) tessellata*'), and so there is no primary homonymy between these two names and the replacement name *emrahi* Koçak becomes a junior objective synonym of *tessellata* Charpentier (see p. 28). Koçak was, on the other hand, correct in thinking that *L. vittata* Charpentier was a junior primary homonym of *L. vittata* Thunberg, and so the currently valid name for *vittata* Charpentier is the replacement name *veyseli* Koçak (see p. 28).

The subgeneric assignment of the species included in the present study is shown below.

Platycleis (Platycleis) albopunctata (Goeze)
P. (P.) sabulosa Azam
P. (P.) affinis Fieber
P. (P.) romana Ramme
P. (P.) falx (Fabricius)
P. (P.) intermedia (Serville)
P. (Sepiana) sepium (Yersin)
P. (Tessellana) tessellata (Charpentier)
P. (T.) veyseli Koçak (= *P. vittata* (Charpentier))
P. (Montana) montana (Kollar)
P. (M.) stricta (Zeller)

Harz (1969) recognized about a dozen subspecies among the species of *Platycleis* s.l. included in this study. As Harz pointed out, many of these are based on inadequate material and most if not all of them are, in my view, better regarded as no more than local forms. I have been able to record and study the songs of several of these nominal subspecies and have found no differences from the songs of more typical populations. I have also decided (in agreement with Heller, 1988) to treat *grisea* as being no more than subspecifically distinct from *albopunctata* on the following grounds: (a) the two taxa are parapatric, (b) the morphological differences between them (solely in genitalia) are slight, (c) populations from the zone of contact seem to be morphologically intermediate, and (d) there is no apparent difference in the songs. Thus *grisea* reverts to the status it had before Zeuner (1940, 1941) first took the view that it was specifically distinct from *albopunctata*. Experimental studies on interbreeding between these two forms would be most useful.

THE SONG AS A TAXONOMIC CHARACTER

I have recently outlined the history of the use of the songs of Orthoptera in taxonomy (Ragge, 1986: 219–220). Much of the early work on the songs of Tettigoniidae was carried out in North America, where the pioneering studies of Scudder (1867, 1868, 1893) deserve a special mention. Like Yersin (1854*b*), who worked a little earlier in Europe, Scudder portrayed the songs he described in the form of musical notation. In 1932 Fulton produced keys to the Tettigoniidae and Gryllidae of North Carolina based on their songs, again a little later than the first attempt to do likewise in Europe (Faber, 1928). In each case it is highly improbable that the Americans were aware of the work by their European counterparts.

The taxonomic value of the male calling songs of the western European species of *Platycleis* can be seen at a glance from Figs 36–48. There is a wide range of patterns from the regularly repeated short echemes of *albopunctata* and *sabulosa* to the mixture of short and quite different, long echemes of *stricta*. The seven larger species, from *albopunctata* to *sepium*, have songs consisting of a series of well-defined echemes; microsyllables are regularly produced by *affinis*, *romana* and *falx*, but are exceptional or completely lacking in the songs of the other four. In the songs of two of the smaller species, *tessellata* and *veyseli*, there are no well-defined echemes and no microsyllables: the syllables are either grouped into very loose and irregular echemes or are produced in long, even sequences of indefinite duration. The other two small species, *montana* and *stricta*, produce well-defined echemes; those of *montana* are of uniform duration and have no microsyllables, but those of *stricta* consist of a series of short echemes with microsyllables, interspersed with longer ones in which microsyllables may or may not be present.

Among the larger species, *falx* stands alone in producing echemes of at least 25 syllables and of fairly uniform duration within one song. The remaining six large species fall into three pairs: *intermedia* and *sepium* both produce disyllabic echemes, *albopunctata* and *sabulosa* produce echemes of 3–7 syllables (but an almost constant number within one song), and *affinis* and *romana* produce a mixture of short and long echemes in the same song. The similarities in the songs of *intermedia* and *sepium* are certainly no indication of affinity as these species differ markedly in morphology. However, the members of each of the other two pairs may well be fairly closely related to each other, especially *albopunctata* and *sabulosa*, which are largely allopatric and have probably diverged fairly recently.

I have been unable to find any significant difference between the songs of *tessellata* and *veyseli*. These two species are also very similar in morphology, differing mainly in wing-development, and are largely allopatric. They are almost certainly sister species that have evolved quite recently from a common ancestor, and it would be most interesting to find out experimentally whether they will readily hybridize.

The last two species, *montana* and *stricta*, are also largely allopatric and show some similarities in both song and morphology, but the relationship is much less close than in *tessellata* and *veyseli*.

The difficulties mentioned on p. 6 in defining *Platycleis* and *Metrioptera* as separate genera on

morphological grounds are reflected by the songs. The species of *Metrioptera* s.l. show a similar variety of song-patterns, some including microsyllables and matching the songs of *Platycleis* species quite closely.

PLATYCLEIS Fieber

Chelidoptera Wesmael, 1838: 591 [as subgenus of *Decticus* Serville]. Type species: *Locusta grisea* Fabricius [now a subspecies of *P. albopunctata* (Goeze)], by subsequent designation (Kirby, 1906: 203). [Homonym of *Chelidoptera* Gould, 1836: 81.]

Platycleis Fieber, in Kelch, 1852: 5. Type species: *Locusta grisea* Fabricius [now a subspecies of *P. albopunctata* (Goeze)], by subsequent designation (Kirby, 1906: 203).

DIAGNOSIS. ♂♀. Pronotal disc fairly flat, with median carina in at least metazona. Fore tibiae with three external dorsal spurs. Brachypterous to macropterous. Male cerci with single internal tooth. Female subgenital plate with either median groove or median carina. Ovipositor upcurved. General colour usually grey-brown or yellow-brown.

DISCUSSION. The more typical fully winged, grey-brown members of the genus are easy to recognize as belonging to *Platycleis*. Partly green, brachypterous bush-crickets, in which the female subgenital plate lacks either a median groove or a median carina but which are otherwise very similar to *Platycleis*, are likely to belong to *Metrioptera*, but there is no clear dividing line between these two genera.

The male calling songs show a wide range of patterns in *Platycleis*, as discussed on p. 7, and are of little diagnostic value at the generic level. As in *Metrioptera*, microsyllables (see p. 4) are present in the songs of a number of species.

The subgenera are discussed on p. 6.

DISTRIBUTION. Europe as far north as southern Scandinavia, the whole of the Mediterranean Region, temperate Asia as far as China, including Kashmir and the extreme north of Pakistan; Azores, Madeira and Canary Islands.

INCLUDED SPECIES. As discussed on p. 6 I prefer to regard all the new genera proposed by Zeuner (1941) in his '*Platycleis*-group', together with *Eumetrioptera* Miram, as subgenera of *Platycleis*. All these nominal genera have been previously treated as subgenera except, as far as I know, for the following, which I am here formally reducing in rank to subgenera of *Platycleis*: *Semenoviana* Zeuner **stat. n.**, *Squamiana* Zeuner **stat. n.**, *Sporadiana* Zeuner **stat. n.** and *Eumetrioptera* Miram **stat. n.** *Alticolana* Zeuner was cited by Bei-Bienko (1951: 162) as a subgenus of *Metrioptera*, but as it belongs to Zeuner's *Platycleis*-group I am treating it here as a subgenus of *Platycleis*.

The currently valid species of *Platycleis* are listed below, segregated alphabetically under their respective subgenera. As indicated in the list, 19 specific names are newly combined with *Platycleis* as a result of the reduction in rank to subgenus of the genera with which they were formerly combined.

Genus *Platycleis* Fieber, 1852
- Subgenus *Platycleis* Fieber, 1852
  - *affinis* Fieber, 1853
  - *albopunctata* (Goeze, 1778)
  - *alexandra* (Uvarov, 1927)
  - *concii* Galvagni, 1959
  - *curvicauda* Podgornaya, 1988
  - *escalerai* Bolívar, 1899
  - *falx* (Fabricius, 1775)
  - *fatima* Uvarov, 1912
  - *iberica* Zeuner, 1941
  - *iljinskii* Uvarov, 1917
  - *intermedia* (Serville, [1838])
  - *irritans* Ramme, 1951
  - *kabulica* Bei-Bienko, 1967
  - *kashmira* (Uvarov, 1930)
  - *latitabunda* Stolyarov, 1969
  - *longicauda* (Tarbinskii, 1930)
  - *meridiana* Stolyarov, 1969
  - *pamirica* (Ramme, 1930)
  - *pathana* Zeuner, 1941
  - *ragusai* Ramme, 1927
  - *romana* Ramme, 1927
  - *sabulosa* Azam, 1901
  - *sinuata* Ramme, 1951
  - *sogdiana* Mishchenko, 1952
  - *trivittata* Bei-Bienko, 1951
  - *waltheri* Harz, 1966
- Subgenus *Squamiana* Zeuner, 1941
  - *kurmana* (Ramme, 1951) **comb. n.**
  - *squamiptera* Uvarov, 1912
  - *weidneri* (Demirsoy, 1974) **comb. n.**
- Subgenus *Alticolana* Zeuner, 1941
  - *alticola* (Tarbinskii, 1930) **comb. n.**
  - *atroflava* (Bei-Bienko, 1951) **comb. n.**
- Subgenus *Eumetrioptera* Miram, 1935
  - *beybienkoi* (Bekuzin, 1978) **comb. n.**
  - *mistshenkoi* (Bekuzin, 1961) **comb. n.**
  - *monochroma* (Bei-Bienko, 1947) **comb. n.**
  - *obuchovae* (Mishchenko, 1949) **comb. n.**
  - *pavlovskyi* (Miram, 1935) **comb. n.**
- Subgenus *Sepiana* Zeuner, 1941
  - *sepium* (Yersin, 1854))

Subgenus *Tessellana* Zeuner, 1941
lagrecai (Messina, 1979) **comb. n.**
nigrosignata (Costa, 1863)
orina (Burr, 1899)
seniae Finot, 1893
sporadarum (Werner, 1933)
tessellata (Charpentier, 1825)
veyseli Koçak, 1984
Subgenus *Incertana* Zeuner, 1941
chopardi (Jannone, 1936)
erecta (Uvarov, 1939)
incerta Brunner, 1882
persica Uvarov, 1917
Subgenus *Parnassiana* Zeuner, 1941
chelmos (Zeuner, 1941)
coracis Ramme, 1920
dirphys (Willemse, 1980)
fusca Brunner, 1882
gionica (La Greca & Messina, 1976)
menalon (Willemse, 1975)
nigromarginata Willemse & Willemse, 1987
panaetolikon (Willemse, 1980)
parnassica (Ramme, 1926)
parnon (Willemse, 1980)
tymphiensis (Willemse, 1973)
tymphrestos (Zeuner, 1941)
vicheti (Delmas & Rambier, 1950)
Subgenus *Decorana* Zeuner, 1941
arabica Popov, 1981
buxtoni (Uvarov, 1923) **comb. n.**
capitata Uvarov, 1917
concinna (Walker, 1869) **comb. n.**
decorata Fieber, 1853
himalayana (Ramme, 1933) **comb. n.**
kabila Finot, 1893
yalvaci (Demirsoy, 1974) **comb. n.**
Subgenus *Sporadiana* Zeuner, 1941
brevipes (Uvarov, 1934) **comb. n.**
Subgenus *Semenoviana* Zeuner, 1941
plotnikovi Uvarov, 1912
similis (Tarbinskii, 1930) **comb. n.**
tadzhika (Bei-Bienko, 1933) **comb. n.**
tamerlana (Saussure, 1874) **comb. n.**
tricarinata (Tarbinskii, 1930) **comb. n.**
Subgenus *Montana* Zeuner, 1941
ankarensis (Karabağ, 1950)
armeniaca (Ramme, 1930)
barretii Burr, 1912
bifoveolata (Karabağ, 1950)
carpetana Bolívar, 1887
daghestanica Uvarov, 1917
decticiformis Shchelkanovtsev, 1914
dubia Uvarov, 1910
elegans (Uvarov, 1934)
eversmanni (Kittary, 1849)
heinrichi (Ramme, 1929)
macedonica (Berland & Chopard, 1922)
medvedevi (Miram, 1927)
montana (Kollar, 1833)
montenegrina (Ramme, 1933)
richteri Bei-Bienko, 1958
schereri Werner, 1901
striata (Kittary, 1849)
stricta (Zeller, 1849)
taurica Bolívar, 1899
tianshanica (Uvarov, 1933)
tomini Pylnov, 1916
uvarovi (Karabağ, 1950)
Subgenus *Modestana* Beier, 1955
ebneri (Ramme, 1926)
kraussi Padewieth, 1900
modesta Fieber, 1853

KEYS TO THE PRINCIPAL WESTERN EUROPEAN SPECIES OF *PLATYCLEIS*

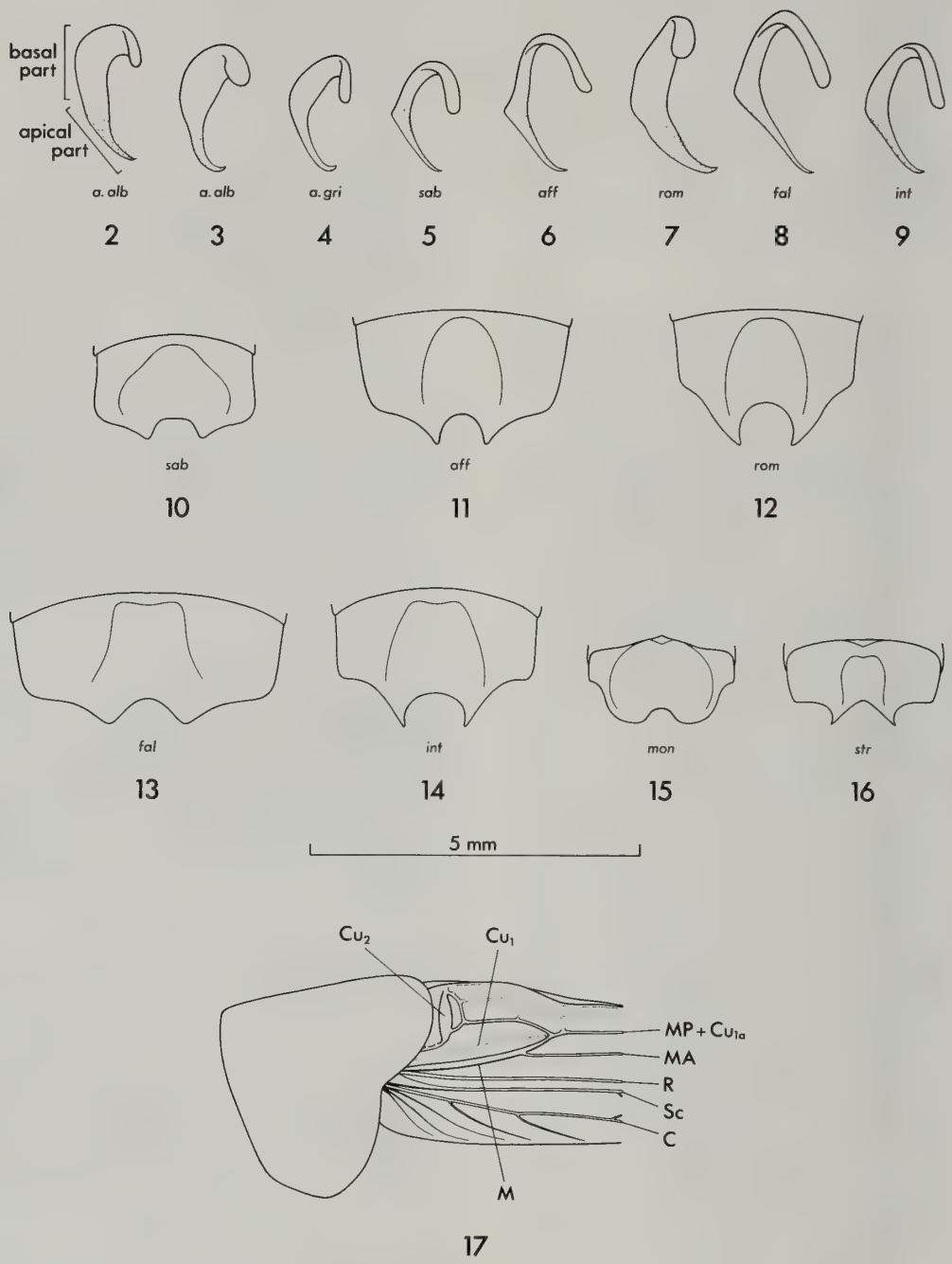
The only western European species not included in these keys are very local forms, often of doubtful status, in which the song is unknown to me.

Two keys are provided here, one based on morphological characters and the other on the male calling songs. Several of the larger species are very difficult to separate morphologically and, in the absence of song information, some specimens may not be correctly identified using the morphological key. Reference should in any case always be made to the notes on recognition given in the accounts of each species. *For reliable identification the song should be used whenever possible.*

KEY BASED ON MORPHOLOGICAL CHARACTERS

This key is for adults that are freshly collected or well preserved, particularly without undue shrinkage at the tip of the abdomen. The male tenth abdominal tergite is especially liable to collapse on drying, thus obscuring the useful specific characters that it otherwise shows; this is also true, to a lesser extent, of the female subgenital plate. For the method of examining the male titillators see p. 6. Males of the larger species, especially *sabulosa*, *affinis* and *intermedia*, are particularly difficult to identify from morphological characters, and associated females should be used for identification whenever possible.

1 Brachypterous, the fore wings not reaching the tip of the abdomen and the hind wings not reaching the tips of the fore wings 2



Figs 2–17 Male genitalia and stridulatory organ of species of *Platycleis*. 2–9. Dorsal view of the right titillator of (2) *P. albopunctata albopunctata* (eastern Pyrenees), (3) *P. a. albopunctata* (southern Spain), (4) *P. a. grisea*, (5) *P. sabulosa*, (6) *P. affinis*, (7) *P. romana*, (8) *P. falx*, (9) *P. intermedia*. 10–16. Dorsal view of the male tenth abdominal tergite of (10) *P. sabulosa*, (11) *P. affinis*, (12) *P. romana*, (13) *P. falx*, (14) *P. intermedia*, (15) *P. montana*, (16) *P. stricta*. 17. Dorsolateral view of the stridulatory area of the left male fore wing of *P. affinis*, showing the wing-vein terminology used in this paper. Note that the male tenth abdominal tergite collapses in some dried specimens, after which its appearance can be quite different from that shown in Figs 10–16.

– Fully winged, the fore wings reaching beyond the tip of the abdomen and the hind wings reaching the tips of the fore wings 3

2 Smaller: length of the pronotum less than 5 mm; length of the hind femora less than 18 mm .. ***veyseli***

– Larger: length of the pronotum more than 6 mm; length of the hind femora more than 22 mm ..... ***sepium***

3 Male 4

– Female 13

4 Smaller: length of the pronotum less than 5 mm; length of the hind femora less than 17 mm 5

– Larger: length of the pronotum more than 5 mm; length of the hind femora more than 17 mm 7

5 Inner tooth of the cerci nearer the tip than the base ..... ***tessellata***

– Inner tooth of the cerci nearer the base than the tip 6

6 Tenth abdominal tergite with rounded lobes (Fig. 15) ..... ***montana***

– Tenth abdominal tergite with pointed lobes (Fig. 16) ..... ***stricta***

7 Larger: length of the pronotum more than 6·5 mm; length of the hind femora more than 26 mm. Tenth abdominal tergite shaped as in Fig. 13 ..... ***falx***

– Smaller: length of the pronotum usually less than 6·5 mm; length of the hind femora less than 26 mm. Tenth abdominal tergite not shaped as in Fig. 13 .. 8

8 Titillators with relatively broad basal part, as in Figs 2–4 or 7 9

– Titillators with relatively narrow basal part, as in Figs 5, 6 or 9 11

9 From Italy 10

– Not from Italy ..... ***albopunctata***

10 Titillators with relatively robust apical part, as in Fig. 7 ..... ***romana***

– Titillators with relatively slender apical part, as in Fig. 4 ..... ***albopunctata***

11 Lobes of the tenth abdominal tergite not sharply pointed, as in Fig. 10 ..... ***sabulosa***

– Lobes of the tenth abdominal tergite fairly sharply pointed, as in Figs 11 or 14 12

12 *M* of the fore wings conspicuously pale-coloured at the base (see Fig. 17) ..... ***affinis***

– *M* of the fore wings not conspicuously pale-coloured at the base ..... ***intermedia***

13 Ovipositor less than 6 mm long, sharply curved upwards from near the base, as in Fig. 33 ... ***tessellata***

– Ovipositor more than 7 mm long, not shaped as in Fig. 33 14

14 Seventh abdominal sternite completely unmodified as in Figs 18, 19, 27 or 28 15

– Seventh abdominal sternite with one or more swellings or ridges, as in Figs 20–24 17

15 Subgenital plate truncate, as in Fig. 27 ... ***montana***

– Subgenital plate clearly bilobed, as in Figs 18–24 or 28 16

16 Length of the fore wings more than 18 mm. Ovipositor shaped as in Fig. 29 ..... ***albopunctata***

– Length of the fore wings less than 18 mm. Ovipositor shaped as in Fig. 35 ..... ***stricta***

17 Seventh abdominal sternite with a single transverse ridge, often more pronounced towards the sides, as in Fig. 20 ..... ***sabulosa***

– Seventh abdominal sternite with a central swelling (Figs 21–23) or two transverse ridges (Fig. 24) ... 18

18 Seventh abdominal sternite with two transverse ridges, as in Fig. 24 ..... ***intermedia***

– Seventh abdominal sternite with a central swelling, as in Figs 21–23 19

19 Subgenital plate with prominent paired protuberances towards the base, as in Fig. 23. Ovipositor more than 2 mm deep at the base of the dark-coloured part ..... ***falx***

– Subgenital plate without such protuberances. Ovipositor less than 2 mm deep at the base of the dark-coloured part 20

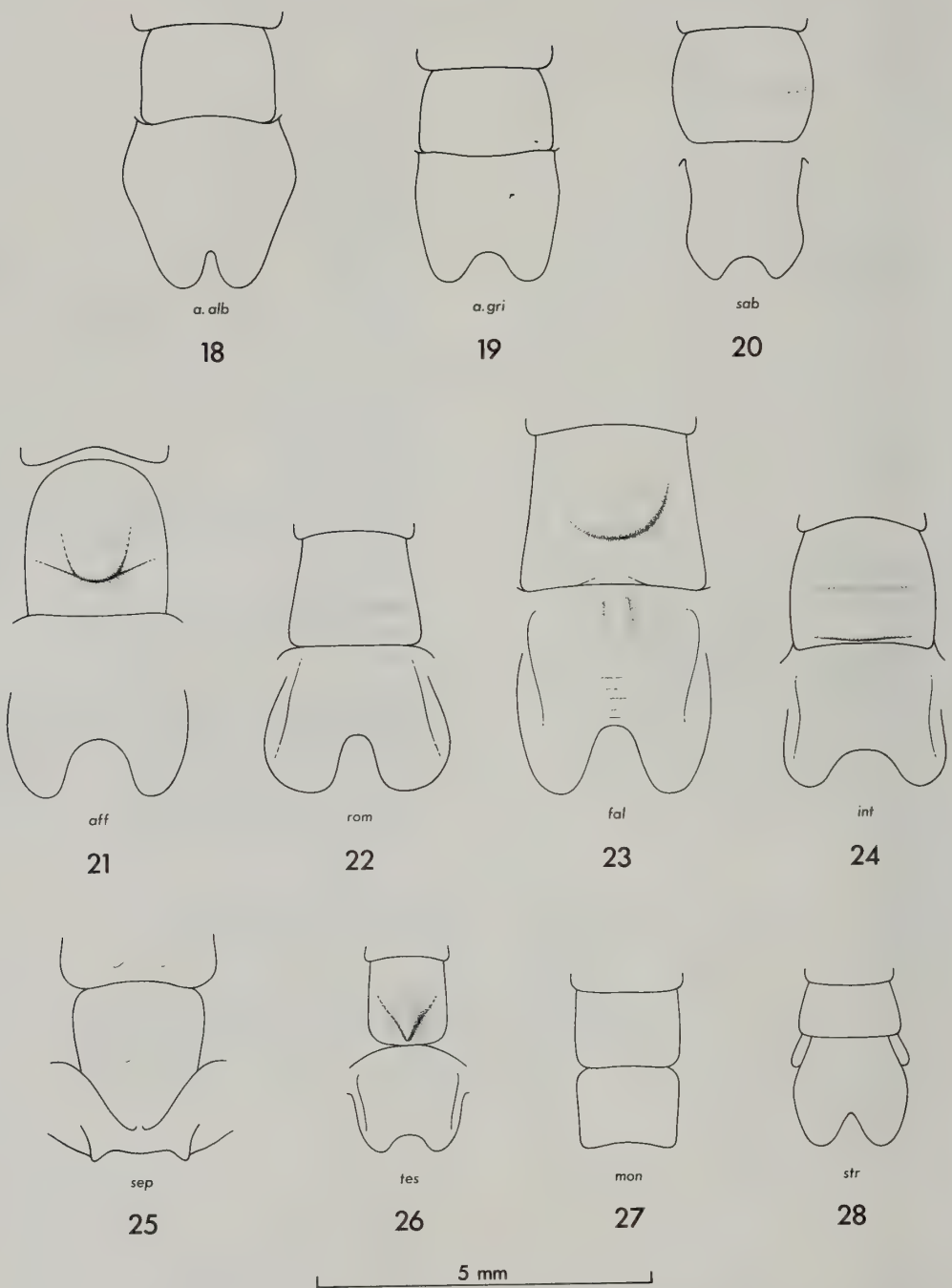
20 Subgenital plate with very broad lobes, as in Fig. 22. Ovipositor more strongly curved, as in Fig. 31, usually less than 11·5 mm long ..... ***romana***

– Subgenital plate with narrower lobes, as in Fig. 21. Ovipositor more gently curved, as in Fig. 30, usually more than 11·5 mm long ..... ***affinis***

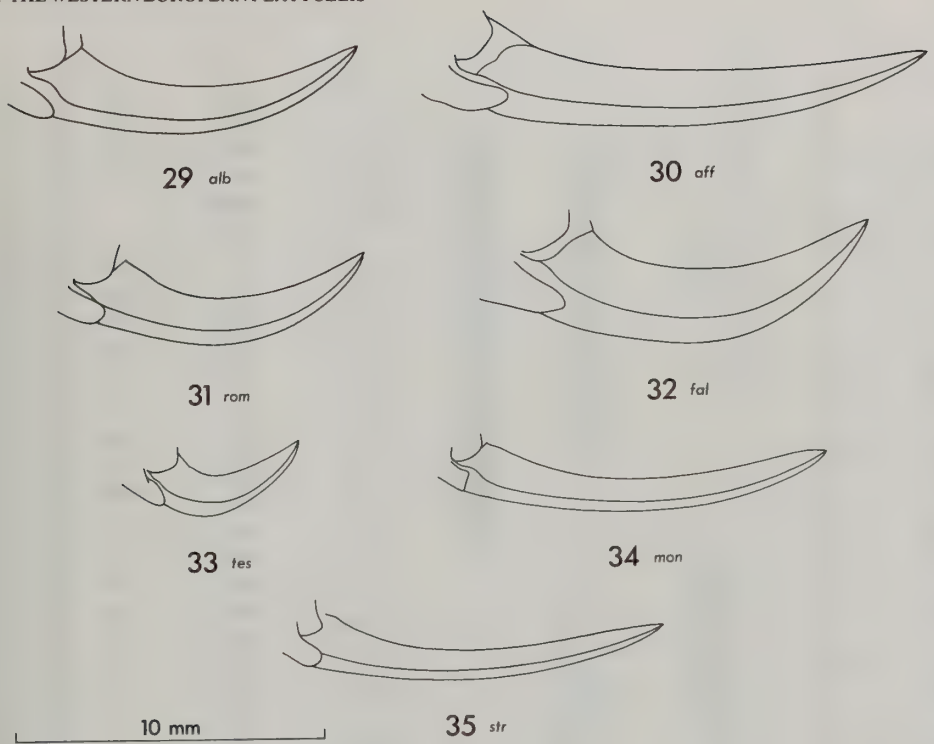
KEY BASED ON SONG CHARACTERS (see especially Figs 36–48)

The larger species have quite loud songs that are clearly audible in ordinary outdoor conditions to anyone with good high-frequency hearing; for these species the key is based on the calling songs that are produced in warm weather. The four small species, *tessellata, veyseli, montana* and *stricta*, have songs that are too quiet to be heard in most outdoor situations, and for these species the key is based on the calling songs that are produced by captive males in quiet indoor conditions, especially at night.

Many of the song differences can be detected by careful listening with the human ear assisted by the second hand (or digital count) of a watch, but some of the couplets require oscillographic analysis, or at least the means of playing back a



Figs 18–28 Ventral view of the female terminal abdominal sternites of (18) *Platycleis albopunctata albopunctata*, (19) *P. a. grisea*, (20) *P. sabulosa*, (21) *P. affinis*, (22) *P. romana*, (23) *P. falx*, (24) *P. intermedia*, (25) *P. sepium*, (26) *P. tessellata*, (27) *P. montana*, (28) *P. stricta*.



Figs 29–35 Lateral view of the ovipositor of (29) *Platycleis albopunctata*, (30) *P. affinis*, (31) *P. romana*, (32) *P. falx*, (33) *P. tessellata*, (34) *P. montana*, (35) *P. stricta*.

recorded song at a slower tape speed. I have been unable to find a consistent difference between the calling songs of *tessellata* and *veyseli*, but these species are completely allopatric in western Europe and easily separated morphologically.

See p. 4 for definitions of the terms 'echeme', 'syllable', 'macrosyllable' and 'microsyllable'.

1 Song consisting of a long series (lasting at least 10 s) of uniformly short echemes or single syllables, in either case lasting less than 0·5 s and repeated regularly at the rate of at least 1/s (Figs 36, 37, 41, 42, 44) 2

– Song consisting of irregularly repeated syllables, or of echemes repeated less frequently than 1/s and at least some lasting more than 0·5 s (Figs 38, 39, 40, 43, 45, 47, 48) 8

2 Song consisting of echemes of 2–10 syllables 3

– Song consisting of ungrouped syllables 7

3 Echemes composed of a single macrosyllable followed by several microsyllables (Figs 123, 125) ..... ***stricta***

– Echemes composed of 2 or more macrosyllables with no microsyllables 4

4 Echemes composed of 2 macrosyllables 5

– Echemes composed of 3 or more macrosyllables .. 6

5 Echeme repetition rate less than 4/s; syllable repetition rate less than 15/s (Figs 103–105) .. ***intermedia***

– Echeme repetition rate more than 4/s; syllable repetition rate more than 15/s (Figs 99–102) ..... ***sepium***

6 Echemes usually composed of 5 or fewer syllables (Figs 49–66) ..... ***albopunctata***

– Echemes usually composed of 6 or more syllables (Figs 67–75) ..... ***sabulosa***

7 In western Europe occurring only in eastern Austria ..... ***veyseli***

– Not occurring in Austria ..... ***tessellata***

8 Song consisting of disyllabic echemes grouped into short sequences of about 2–4 echemes (Fig. 43) ..... ***sepium***

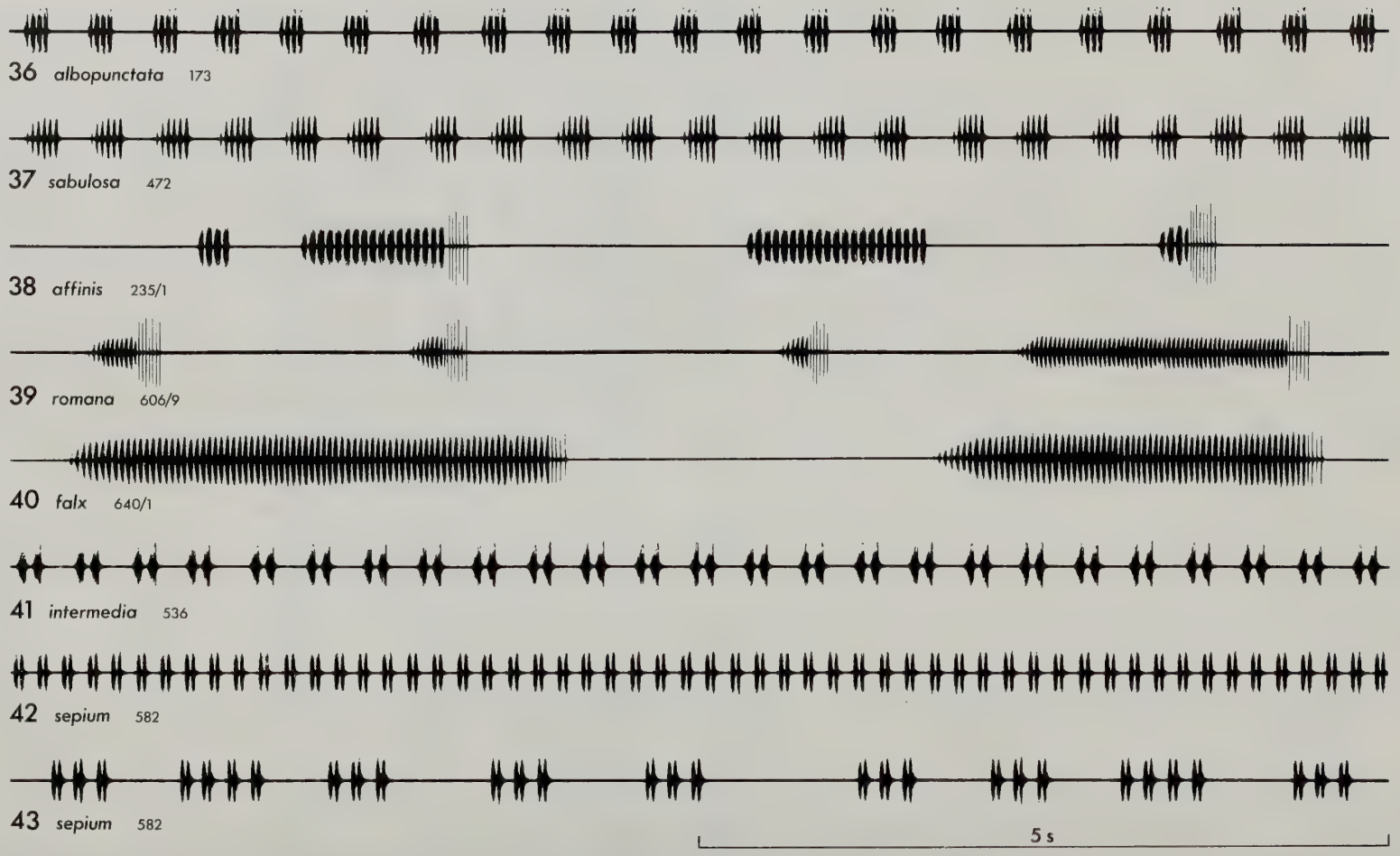
– Song not consisting of disyllabic echemes 9

9 Song consisting of well-separated single syllables repeated irregularly at the rate of less than 7/s ... 10

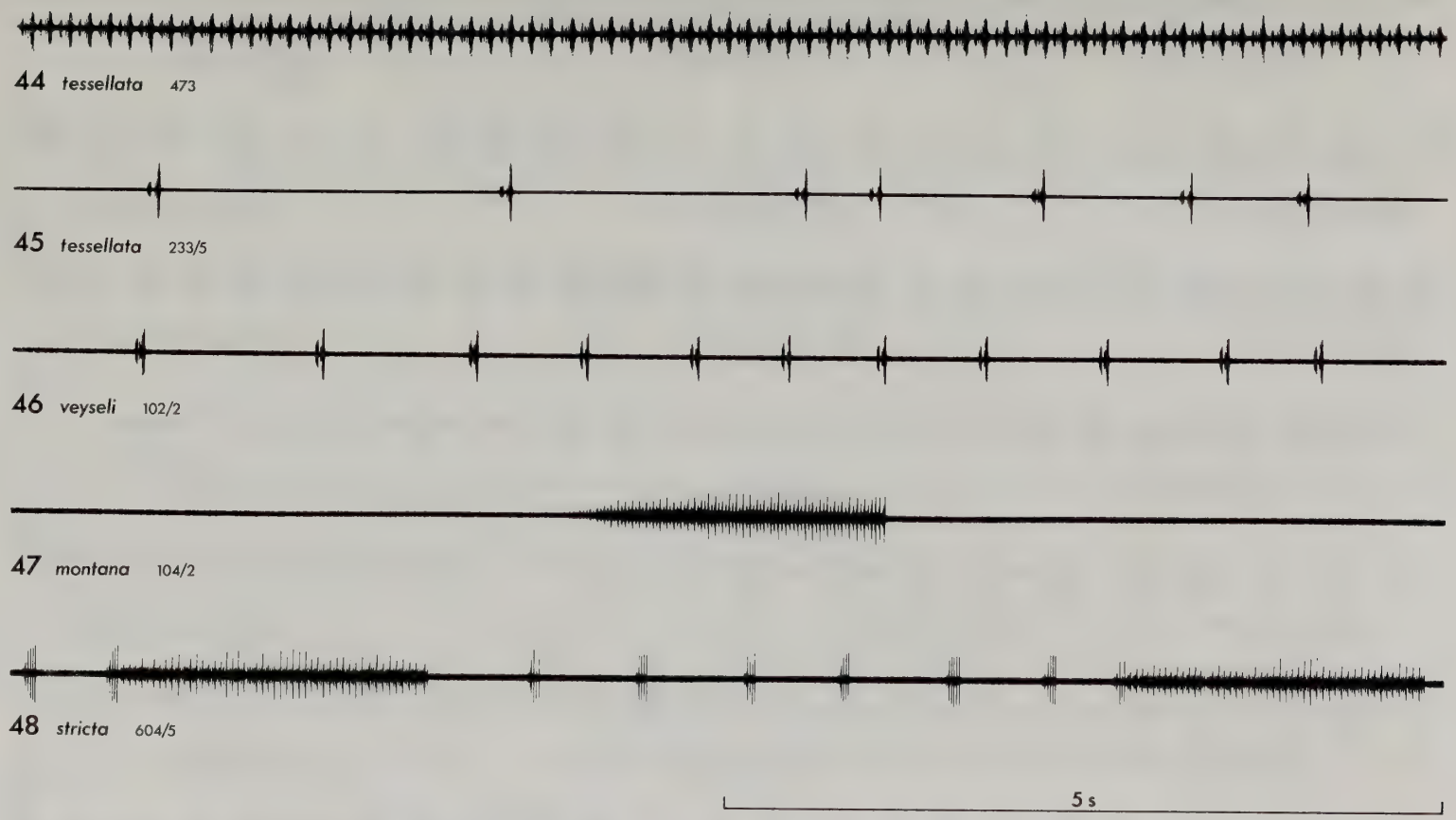
– Song consisting entirely of echemes; syllable repetition rate more than 7/s 11

10 In western Europe occurring only in eastern Austria ..... ***veyseli***

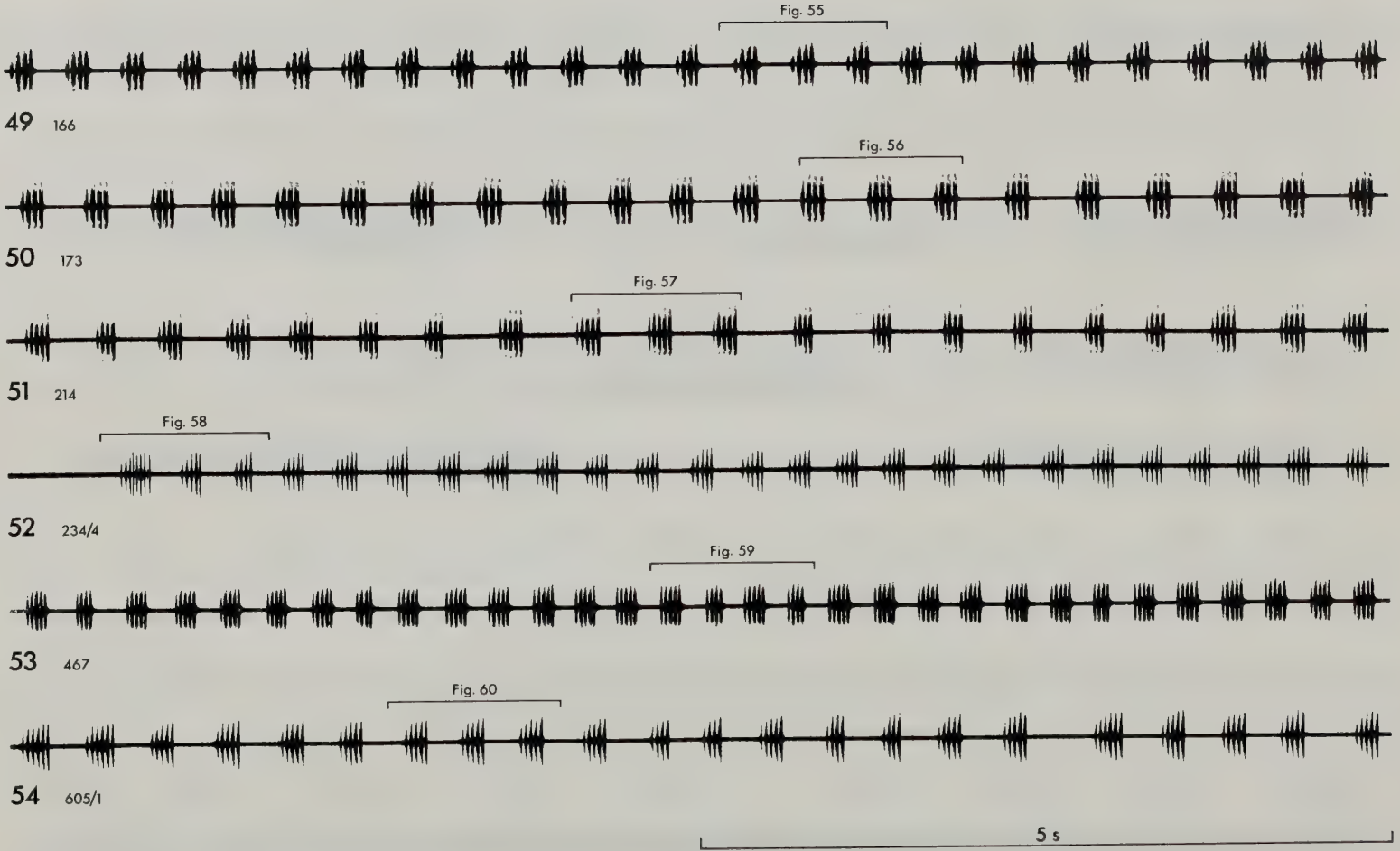
– Not occurring in Austria ..... ***tessellata***



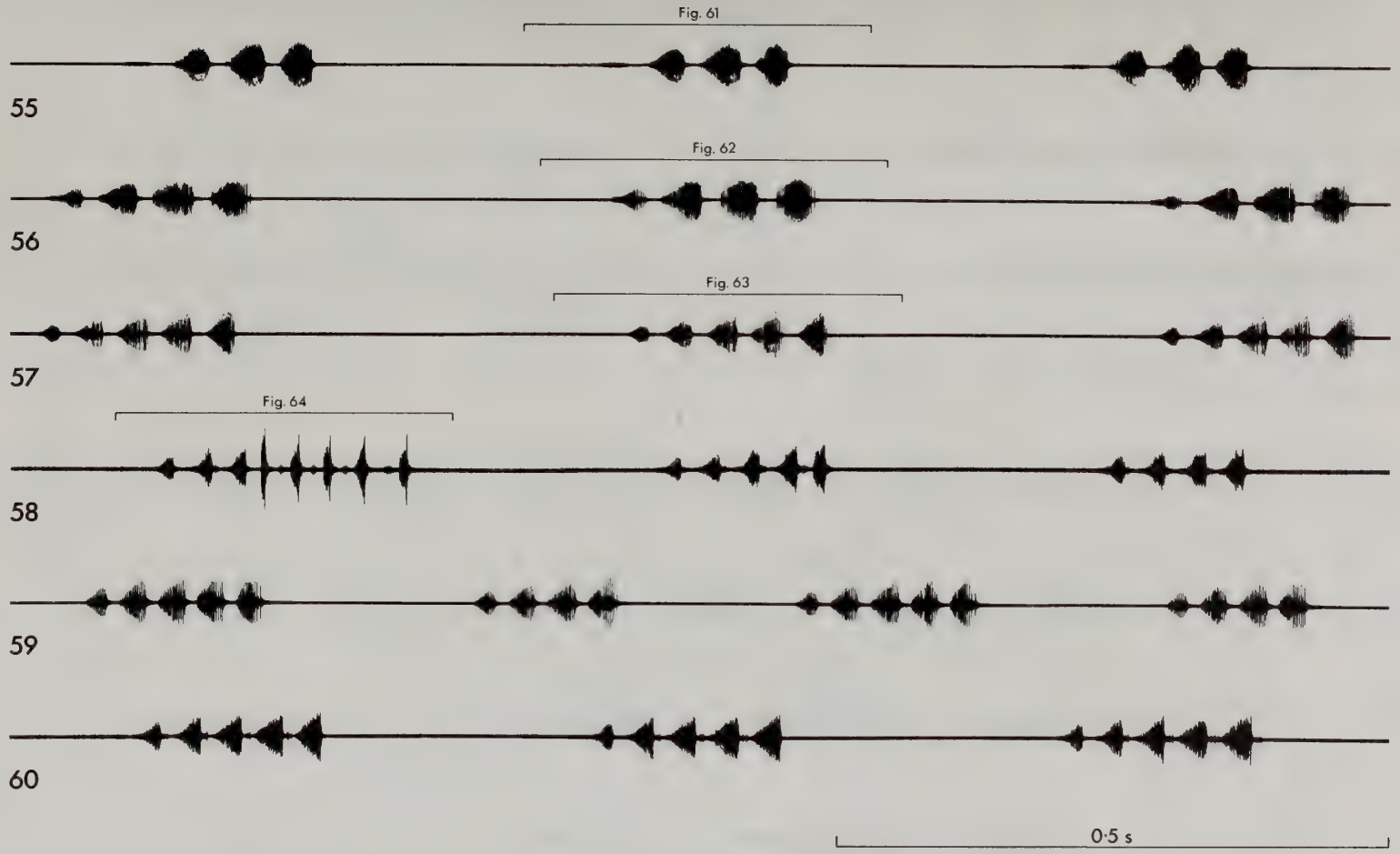
Figs 36–43 Oscillograms of typical male calling songs of species of *Platycleis*. Figs 42 and 43 show the two types of song-pattern produced by males of *P. sepium*. The small numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Tables 1 and 2 (pp. 2, 3).



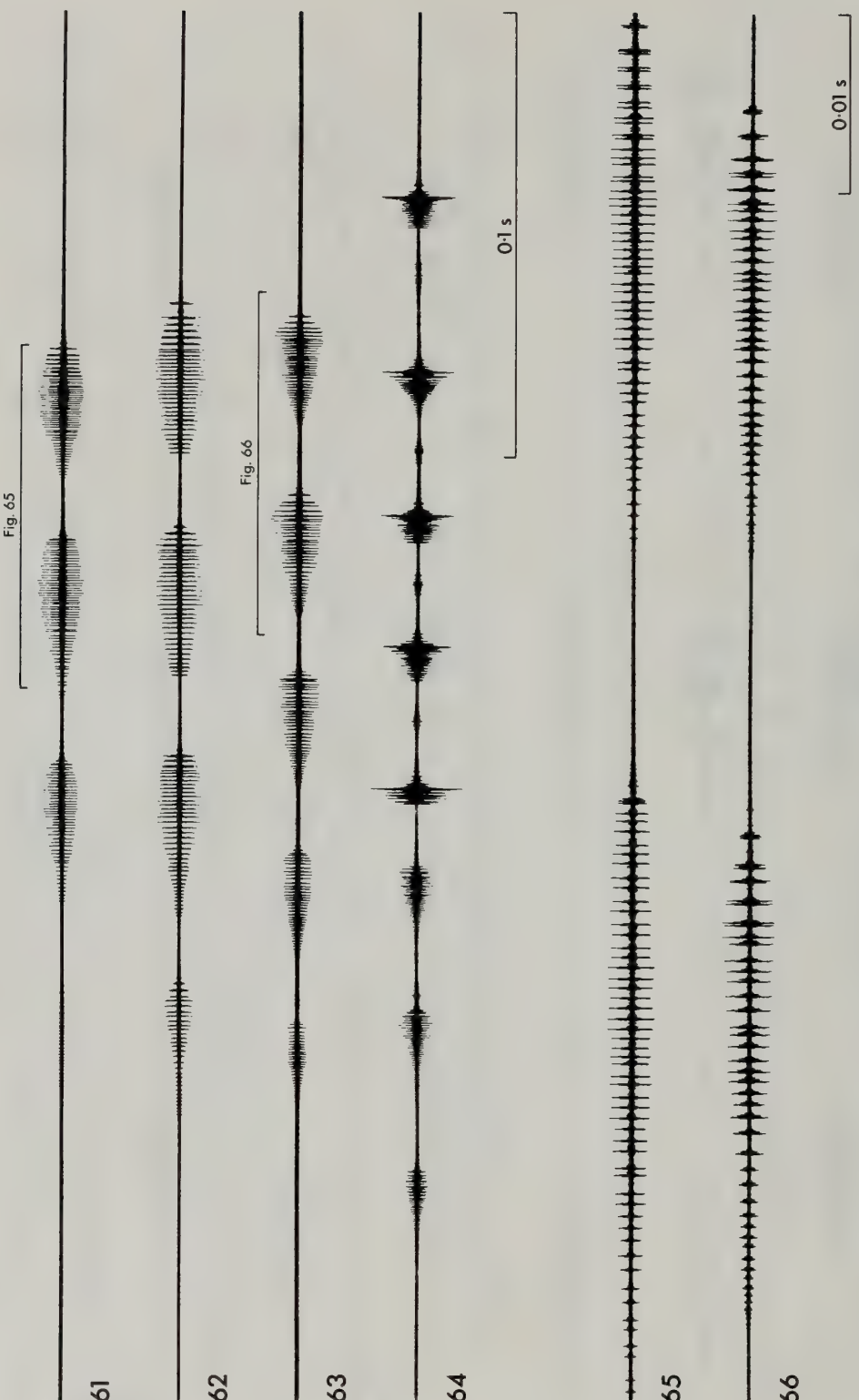
Figs 44–48 Oscillograms of typical male calling songs of species of *Platycleis*. Figs 44 and 45 show the two types of song-pattern produced by males of *P. tessellata*; it is likely that *P. veyseli* also sometimes produces the continuous type of song shown in Fig. 44. The small numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 2 (p. 3).



Figs 49–54 Oscillograms of the callings songs of six males of *Platycleis albopunctata*. Figs 49–53 are from males of *P. a. albopunctata* and Fig. 54 is from a male of *P. a. grisea*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Tables 1 and 2 (pp. 2, 3).



Figs 55–60 Faster oscillograms of the indicated parts of the songs of *Platycleis albopunctata* shown in Figs 49–54.



Figs 61–66 Faster oscillograms of the indicated parts of the songs of *Platycleis albopunctata* shown in Figs 55-58.

11 Song consisting solely of a series of echemes of uniform duration (1–4 s) 12

– Song consisting of a mixture of short (less than 1 s) and long (1–5 s) echemes 13

12 Song consisting of echemes of uniform macrosyllables, often ending with 2–5 microsyllables (Figs 90–98) (Western Mediterranean Region) ..... ***falx***

– Song consisting of echemes of alternately quieter and louder macrosyllables without microsyllables (Figs 115–120) (Not known from the western Mediterranean Region) ..... ***montana***

13 Short echemes consisting of a single macrosyllable followed by several microsyllables (Figs 123, 125) ..... ***stricta***

– Short echemes consisting of more than one macrosyllable, usually followed by several microsyllables 14

14 Syllable repetition rate less than 20/s (Figs 76–83) ..... ***affinis***

– Syllable repetition rate more than 20/s (Figs 84–89) ..... ***romana***

THE SONGS OF THE WESTERN EUROPEAN *PLATYCLEIS*

Platycleis albopunctata (Goeze)

(Figs 2–4, 18, 19, 29, 49–66)

Gryllus (Tettigonia) albo-punctatus Goeze, 1778: 89. Based on Roesel, 1749: pl. 20, figs 8–10 (illustrating three different species); Kaltenbach, 1964: 41, in effect designated a lectotype by restricting the application of the name to the species illustrated in fig. 10. No specimens exist and no type locality was specified.

REFERENCES TO SONG. **Oscillogram**: Ahlén, 1981 (as *denticulata*); Broughton, 1965 (as *d.*); Dubrovin & Zhantiev, 1970 (as *intermedia*); Grein, 1984; Heller, 1988; Latimer, 1981*b*, 1981*c*; Latimer & Broughton, 1984; Samways, 1976*a*; Schmidt & Schach, 1978 (as *grisea*). **Diagram**: Bellmann, 1985*a*; Duijm & Kruseman, 1983; Holst, 1970 (as *d.*); Ragge, 1965 (as *d.*); Samways, 1976*c*; Wallin, 1979 (as *d.*). **Sonagram**: Samways, 1976*a*. **Frequency information**: Ahlén, 1981 (as *d.*); Dubrovin & Zhantiev, 1970 (as *i.*); Heller, 1988; Latimer, 1981*a*, 1981*b*, 1981*c*; Latimer & Broughton, 1984; Sales & Pye, 1974. **Musical notation**: Baier, 1930 (as *g.*); Yersin, 1854*b* (as *g.*). **Verbal description only**: Broughton, 1972; Chopard, 1922; Defaut, 1987; Faber, 1928 (as *g.*); Harz, 1957 (as *d.*); Sarra, 1934 (as *g.*); Yersin, 1857 (as *g.*). **Disc recording**: Grein, 1984; Ragge, Burton & Wade, 1965 (as *d.*). **Cassette recording**: Ahlén, 1982 (as *d.*); Bellmann, 1985*b*; Burton & Ragge, 1987; Wallin, 1979 (as *d.*).

RECOGNITION. Females of this species may be distinguished from other species of similar size by the unmodified seventh abdominal sternite, which has no ridges or other prominences. Males are much more difficult to recognize, but may be distinguished from the closely similar species *sabulosa*, *intermedia*, *affinis* and *falx* by the robust titillators, with their rather short apical part and broad basal part (Figs 2–4).

In the field males may be distinguished from most other western European species of *Platycleis* by their calling song, which consists of long sequences of echemes repeated regularly at the rate of about 2–4/s and each usually composed of 3–5 syllables. The calling songs of *sabulosa* and *intermedia* also consist of echemes repeated at similar rates, but each echeme is usually composed of more than 5 syllables in *sabulosa* and of only 2 syllables in *intermedia*. The echemes of *sepium*, which are also disyllabic, are repeated more rapidly than 4/s and are often grouped into short sequences of 2–4 echemes.

SONG. (Figs 49–66). In warm sunshine the calling song consists of long sequences of echemes repeated fairly regularly at the rate of about 2–4/s and each usually consisting of 3–5 (very rarely 2 and occasionally 6) syllables. Oscillographic analysis shows that the opening hemisyllables are often absent and that the closing hemisyllables usually last about 10–30 ms and are repeated within an echeme at the rate of about 25–35/s. The duration of a single echeme of four syllables is about 100–200 ms and the interval between two echemes is about 100–300 ms. In dull weather and at night the echeme repetition rate can drop to less than 1/s and the syllable repetition rate to less than 10/s; in such conditions the closing hemisyllables sometimes last more than 100 ms and a four-syllable echeme more than 600 ms. The first syllable in an echeme is usually quieter than the remaining ones. Microsyllables are usually absent, but occasionally a few are added at the end of an echeme, especially the opening echeme of a sequence (see Figs 52, 58, 64).

DISTRIBUTION. This species occurs very widely in Europe from southern Scandinavia to the southern peninsulas, where it is mainly confined to uplands. It is also recorded from mountains in Morocco. Further song studies are needed to establish the eastern limit of the range of *albopunctata*. The species can be divided broadly into

two subspecies (see p. 7) on the basis of small morphological differences, mainly the shape of the male titillators (Figs 2–4) and female subgenital plate (Figs 18, 19); there is no difference in the calling song. The nominate subspecies occurs in the westernmost parts of Europe (including Scandinavia, West Germany, southern Britain, France and the Iberian Peninsula) and the eastern subspecies, *P. a. grisea* (Fabricius), from Poland, Czechoslovakia, Austria and Italy eastwards. In parts of East Germany and the Alps transitional forms occur.

Platycleis sabulosa Azam

(Figs 5, 10, 20, 67–75)

Platycleis sabulosa Azam, 1901: 157. Syntypes of both sexes, FRANCE: Fréjus (MNHN, Paris) [putative syntypes examined].

REFERENCES TO SONG. **Oscillogram**: Heller, 1988; Latimer & Broughton, 1984; Samways, 1976*a*. **Diagram**: Samways, 1976*c*. **Sonagram**: Samways, 1976*a*. **Verbal description only**: Defaut, 1987.

RECOGNITION. Females of this species are characterized by the seventh abdominal sternite, which has a pair of lateral protuberances (often connected so as to form a transverse ridge) (Fig. 20). Males are difficult to recognize morphologically, but may be distinguished from *albopunctata* by the shape of the titillators (cf. Figs 2–4, 5) and from *intermedia* and *affinis* by the shape of the tenth abdominal tergite (Fig. 10). Both sexes have a shorter pronotum than *falx* (usually less than 6·5 mm in the male, 7·0 mm in the female; usually more than these values in *falx*).

In the field males may be distinguished from most other western European members of the genus by their calling song, consisting of long sequences of echemes repeated regularly at the rate of about 1–3/s and each usually composed of 6–7 syllables. The calling song of *albopunctata* is quite similar, but its echemes rarely contain more than 5 syllables.

SONG. (Figs 67–75). The calling song consists of long sequences of echemes repeated fairly regularly at the rate of about 1–3/s and each usually consisting of 6–7 (occasionally 5 and rarely up to 10) syllables. Oscillographic analysis shows that the opening hemisyllables are often absent and that the closing hemisyllables usually last about 10–40 ms and are repeated within an echeme at the rate of about 20–40/s. The duration of a single echeme of six syllables is usually about 150–300 ms and the interval between two echemes about 150–500 ms. In dull weather and at night the repetition rates are decreased and the duration of the syllables and echemes increased. The first syllable in an echeme is usually quieter than the remaining ones and the syllables sometimes become steadily louder through most of the echeme. Microsyllables are usually absent.

DISTRIBUTION. The Mediterranean coast of France, the Iberian Peninsula, Morocco and Algeria; also recorded from Sicily, the Canary Islands and Israel.

Platycleis affinis Fieber

(Figs 6, 11, 17, 21, 30, 76–83)

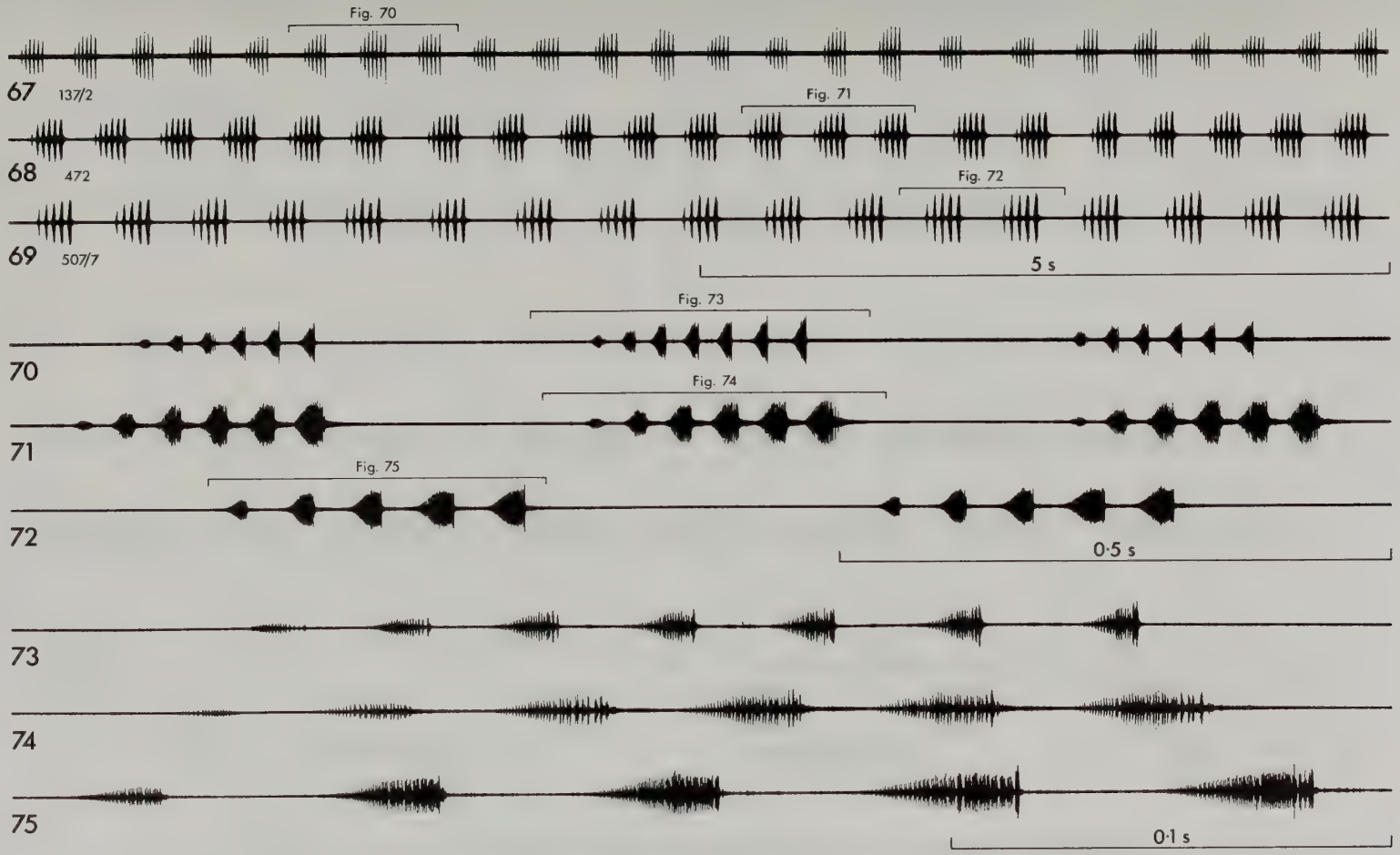
Platycleis affinis Fieber, 1853: 150. Type(s), SOUTHERN EUROPE (lost).

REFERENCES TO SONG. **Oscillogram**: Broughton, 1955, 1965; Heller, 1988; Latimer & Broughton, 1984; Samways, 1976*a*, 1976*b*; Schmidt & Schach, 1978. **Diagram**: Broughton & Lewis, 1979; Samways, 1976*c*. **Sonagram**: Broughton, Samways & Lewis, 1975; Samways, 1976*a*. **Frequency information**: Heller, 1988; Latimer & Broughton, 1984. **Verbal description only**: Defaut, 1987.

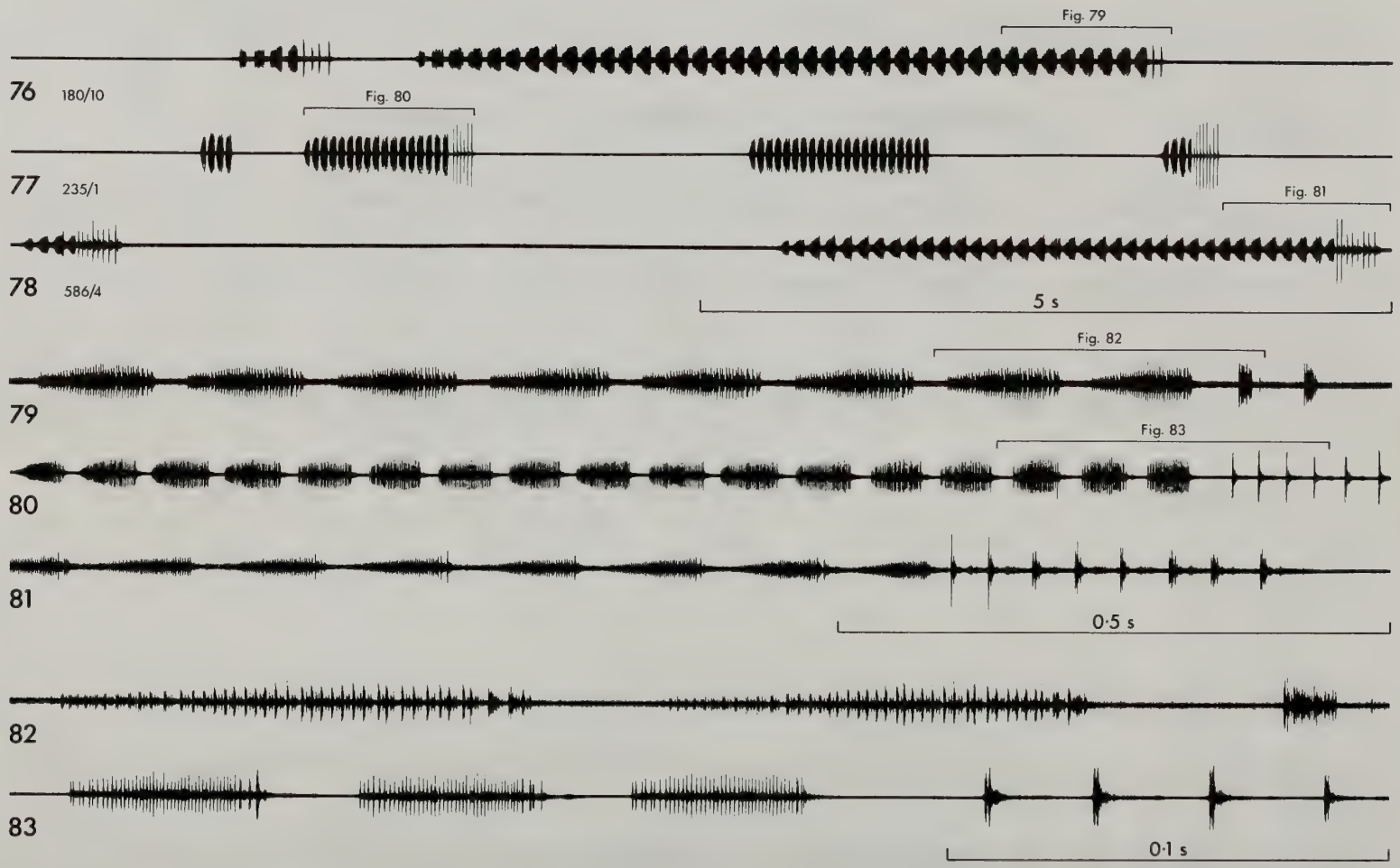
RECOGNITION. Females of this species may be recognized by the seventh abdominal sternite, which has a large median protuberance (Fig. 21); there is a similar protuberance in *falx*, but in that species the ovipositor is shorter and deeper than in *affinis* (cf. Figs 30, 32) and the subgenital plate has a paired prominence towards the base. Males may be distinguished from *albopunctata* by the shape of the titillators (cf. Figs 2–4, 6), from *sabulosa* and *falx* by the shape of the tenth abdominal tergite (cf. Figs 10, 11, 13) and (usually) from *intermedia* by the conspicuously pale-coloured basal part of *M* in the fore wings.

In the field males may be recognized by the calling song, which consists of a mixture of short (less than 1 s) and long (1–5 s) echemes, mostly ending with microsyllables and with a syllable repetition rate of less than 20/s.

SONG. (Figs 76–83). The calling song consists of a mixture of short echemes lasting less than 1 s and usually composed of fewer than 7 macrosyllables, and longer echemes lasting 1–5 s and composed of 8–50 macrosyllables. Each echeme usually ends with a series of 2–9 microsyllables. The echemes are often grouped into one or two short ones followed by a long one, but sometimes they follow one another quite irregularly and occasionally there is a fairly regular sequence of long echemes with few short ones. Oscillographic analysis shows that the opening hemisyllables are usually absent



Figs 67–75 Oscillograms at three different speeds of the calling songs of three males of *Platycleis sabulosa*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Tables 1 and 2 (pp. 2, 3).



Figs 76–83 Oscillograms at three different speeds of the calling songs of three males of *Platycleis affinis*. Fig. 77 is from a typical daytime song in sunny weather; Figs 76 and 78 are from night-time recordings and show the slower rhythm resulting from lower body temperatures. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Tables 1 and 2 (pp. 2, 3).

and that the closing macrosyllables usually last about 30–110 ms and are repeated at the rate of about 10–20/s. The microsyllables usually last about 3–15 ms and are repeated at the rate of about 17–45/s; the microsyllable sequence at the end of an echeme seldom lasts more than 0·3 s. The echemes often begin quietly and the first one or two syllables are often shorter than the remaining ones. The intervals between echemes vary greatly: long echemes often follow short echemes with an interval of less than a second or with no pause at all; intervals of a few seconds are common and sometimes there are longer intervals of 30 s or more.

DISTRIBUTION. Like *intermedia* this species occurs in a large part of the Mediterranean Region, including Morocco and Algeria. Its range extends eastwards to Turkey and southern Asia, and in central Europe it occurs a little further north than *intermedia* in Lower Austria and Hungary.

Platycleis romana Ramme

(Figs 7, 12, 22, 31, 84–89)

Platycleis romana Ramme, 1927: 142. Holotype ♀, ITALY: Lazio, Albany Hills, between Castel Gandolfo and Rocca di Papa, 9.vii.1924 [not '9.III.1926', as stated by Ramme] (*W. Ramme*) (MNHU, Berlin) [examined].

REFERENCES TO SONG. The only original published reference to the song known to me is a very brief mention by Ingrisch (1981: 91) that the song is reminiscent of *affinis*.

RECOGNITION. Females of this species may be recognized by the subgenital plate, which has unusually broad lobes with a fairly narrow median groove (Fig. 22); the seventh abdominal sternite lacks the large protuberance shown by *affinis* and *falx*, but is swollen in the anterior part (Fig. 22). Males may be distinguished from Italian *albopunctata*, *affinis* and *intermedia* by the shape of the titillators (cf. Figs 2–4, 6, 7, 9), and from *sabulosa* and *falx* by the shape of the tenth abdominal tergite (cf. Figs 10, 12, 13).

In the field males may be recognized by the calling song, which consists of a mixture of short and long echemes, each usually ending with microsyllables. The song is thus similar to that of *affinis*, but the syllable repetition rate is much higher, more than 20/s.

SONG. (Figs 84–89). The calling song consists of a mixture of short echemes usually lasting less than 0·5 s and composed of fewer than 10 macrosyllables, and longer echemes lasting up to 3 s and composed of 15–80 macrosyllables. Each echeme usually ends with a series of up to 10 microsyllables. Oscillographic analysis shows that quiet opening hemisyllables are often present; the closing macrosyllables last about 20–30 ms and are repeated at the rate of about 25–40/s. The closing microsyllables last about 2–3 ms and are repeated at the rate of about 35–50/s; the microsyllable sequence at the end of an echeme usually lasts less than 0·3 s. The echemes usually begin quietly and the first one or two syllables are often shorter than the remaining ones. The intervals between echemes vary from less than 1 s to more than 4 s.

DISTRIBUTION. Known only from Italy, where it is quite widespread.

Platycleis falx (Fabricius)

(Figs 8, 13, 23, 32, 90–98)

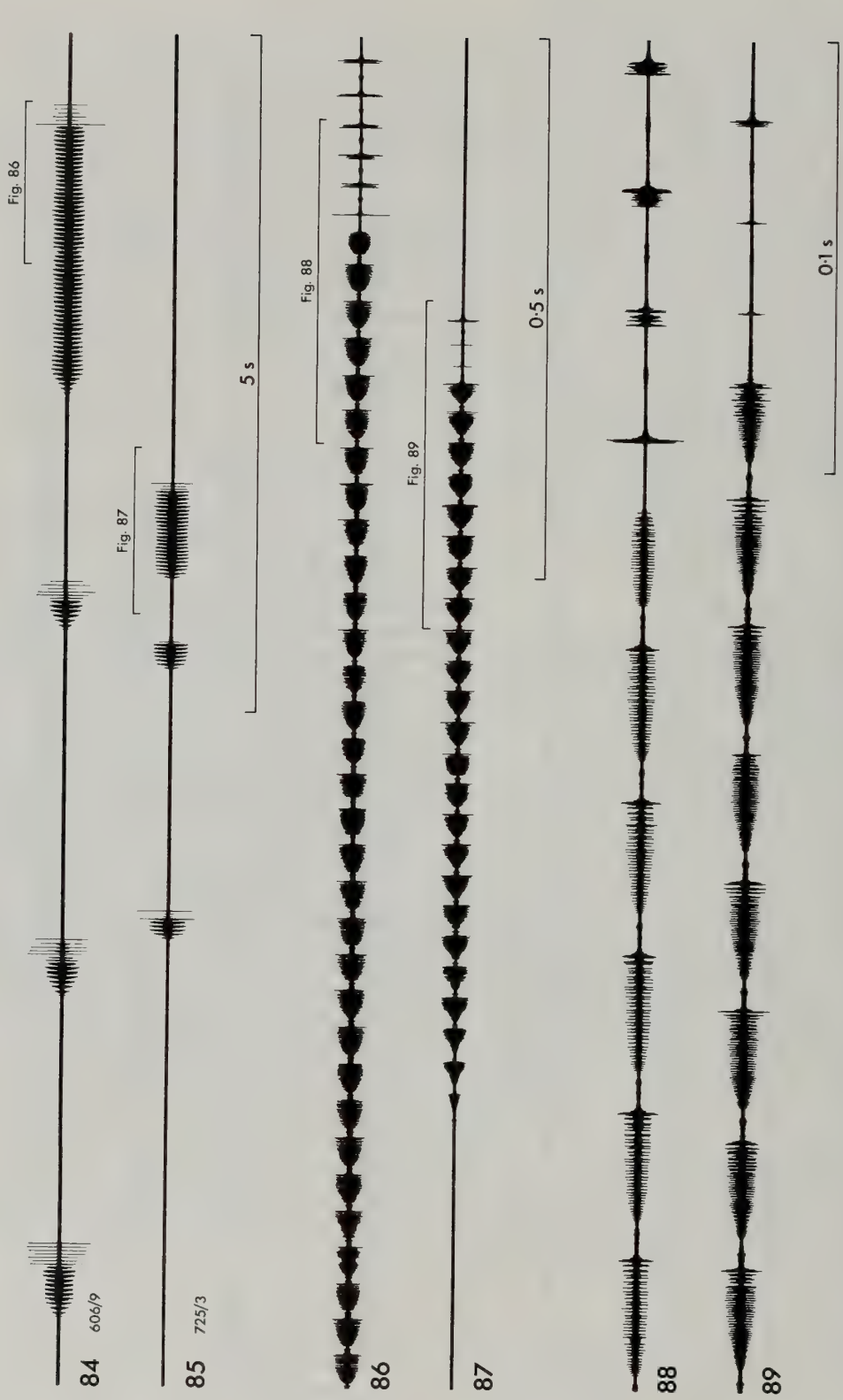
Locusta falx Fabricius, 1775: 286. Lectotype ♀, MADEIRA (BMNH), designated by Uvarov (1930: 402) [examined].

REFERENCES TO SONG. **Oscillogram**: Heller, 1988; Samways, 1976*a*. **Diagram**: Samways, 1976*c*. **Sonagram**: Samways, 1976*a*. **Frequency information**: Busnel, 1955; Heller, 1988. **Verbal description only**: Yersin, 1857 (as *intermedius*).

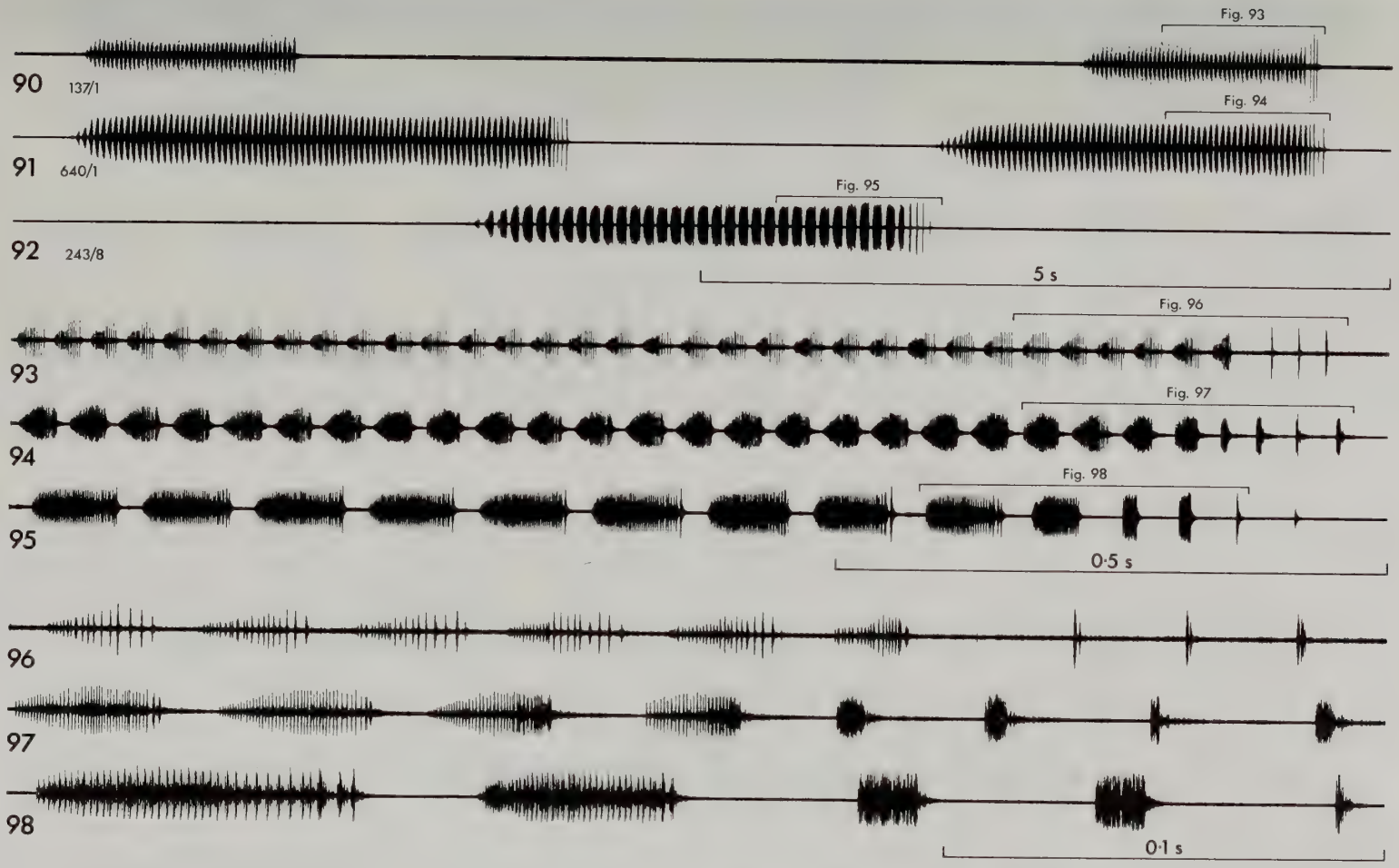
RECOGNITION. Females of this species may be recognized by the paired prominence towards the base of the subgenital plate (Fig. 23), and the large median protuberance on the seventh abdominal sternite (Fig. 23); there is a similar protuberance in *affinis*, but in that species the ovipositor is longer and less deep than in *falx* (cf. Figs 30, 32). Males may be distinguished from *albopunctata* by the shape of the titillators (cf. Figs 2–4, 8), and from *affinis* and *intermedia* by the shape of the tenth abdominal tergite (cf. Figs 11, 13, 14). Both sexes have a longer pronotum than *sabulosa* (usually more than 6·5 mm in the male, 7·0 in the female; usually less than these values in *sabulosa*).

In the field males may be recognized by the calling song, which consists of long sequences of echemes, each usually lasting 1–4 s and often ending with microsyllables. The echemes are fairly uniform in duration within one song (in contrast to the short and long echemes of *affinis* and *romana*) and are usually separated by intervals of about 4–10 s.

SONG. (Figs 90–98). The calling song consists of a long sequence of echemes, each usually lasting 1–4 s, composed of about 25–90 macrosyllables and often ending with about 2–5 microsyllables. Within one song the echemes are usually fairly



Figs 84–89 Oscillograms at three different speeds of the calling songs of two males of *Platycleis romana*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 1 (p. 2).



Figs 90–98 Oscillograms at three different speeds of the calling songs of three males of *Platycleis falx*. Figs 90 and 91 are from typical daytime songs in sunny weather; Fig. 92 is from a night-time recording and shows the slower rhythm resulting from a lower body temperature. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 1 (p. 2).

uniform in duration and are usually separated by intervals of about 4–10 s. Oscillographic analysis shows that the opening hemisyllables are usually absent and that the closing macrosyllables usually last about 20–85 ms and are repeated at the rate of about 10–30/s. The microsyllables usually last about 1–12 ms and are repeated at the rate of about 20–40/s; the microsyllable sequence at the end of an echeme seldom lasts more than 0·2 s. The echemes usually begin quietly, reaching maximum intensity by the third to seventh syllable, and the first one or two syllables are usually shorter than the remaining ones.

DISTRIBUTION. Found on Madeira and in the western Mediterranean Region from Spain and Morocco to the Italian Peninsula and Tunisia.

Platycleis intermedia (Serville)

(Figs 9, 14, 24, 103–105)

Decticus intermedius Serville, [1838]: 488. Syntypes of both sexes, FRANCE: Montpellier and Château-Gombert (lost).

REFERENCES TO SONG. **Oscillogram**: Broughton, 1965 (as *sabulosa*), Elsner & Popov, 1978; Heller, 1988; Latimer & Broughton, 1984; Lewis, 1974; Messina *et al.*, 1980; Samways, 1976*a*, 1976*b*. **Diagram**: Broughton & Lewis, 1979; Samways, 1976*a*, 1976*c*. **Sonagram**: Broughton, Samways & Lewis, 1975; Samways, 1976*a*. **Frequency information**: Heller, 1988; Lewis, Seymour & Broughton, 1975; Zhantiev & Dubrovin, 1971. **Verbal description only**: Chopard, 1952; Pinedo, 1985.

RECOGNITION. Females of *intermedia* may be recognized by the seventh abdominal sternite, which has two prominences, one near the middle and one near the posterior margin (Fig. 24), both variable in shape and size. Males may be distinguished from *albopunctata* by the shape of the titillators (cf. Figs 2–4, 9), from *sabulosa* and *falx* by the shape of the tenth abdominal tergite (cf. Figs 10, 13, 14) and (usually) from *affinis* by the inconspicuously coloured basal part of *M* in the fore wings.

In the field males may be recognized by the calling song (produced mainly in the evening and at night), which consists of long sequences of disyllabic echemes repeated at the rate of 2–3/s. The echemes of *sepium* are also disyllabic, but are repeated more rapidly than 4/s and are often grouped into short sequences of 2–4 echemes.

SONG. (Figs 103–105). The calling song, produced mainly in the evening and at night, consists of long sequences of disyllabic echemes repeated fairly regularly at the rate of about 2–3/s. Oscillographic analysis shows that the opening hemisyllables are usually absent and that the closing hemisyllables usually last about 40–90 ms, the second of each pair often being a little longer, and sometimes louder, than the first. The duration of each echeme is about 130–180 ms and the interval between two echemes is about 140–250 ms. Microsyllables are usually absent.

DISTRIBUTION. Found in a large part of the Mediterranean Region, from Spain and Morocco to Turkey and further east into southern Asia.

Platycleis sepium (Yersin)

(Figs 25, 99–102)

Decticus sepium Yersin, 1854*a*: 68. 3 ♂, 2 ♀ syntypes, FRANCE: Nice (lost).

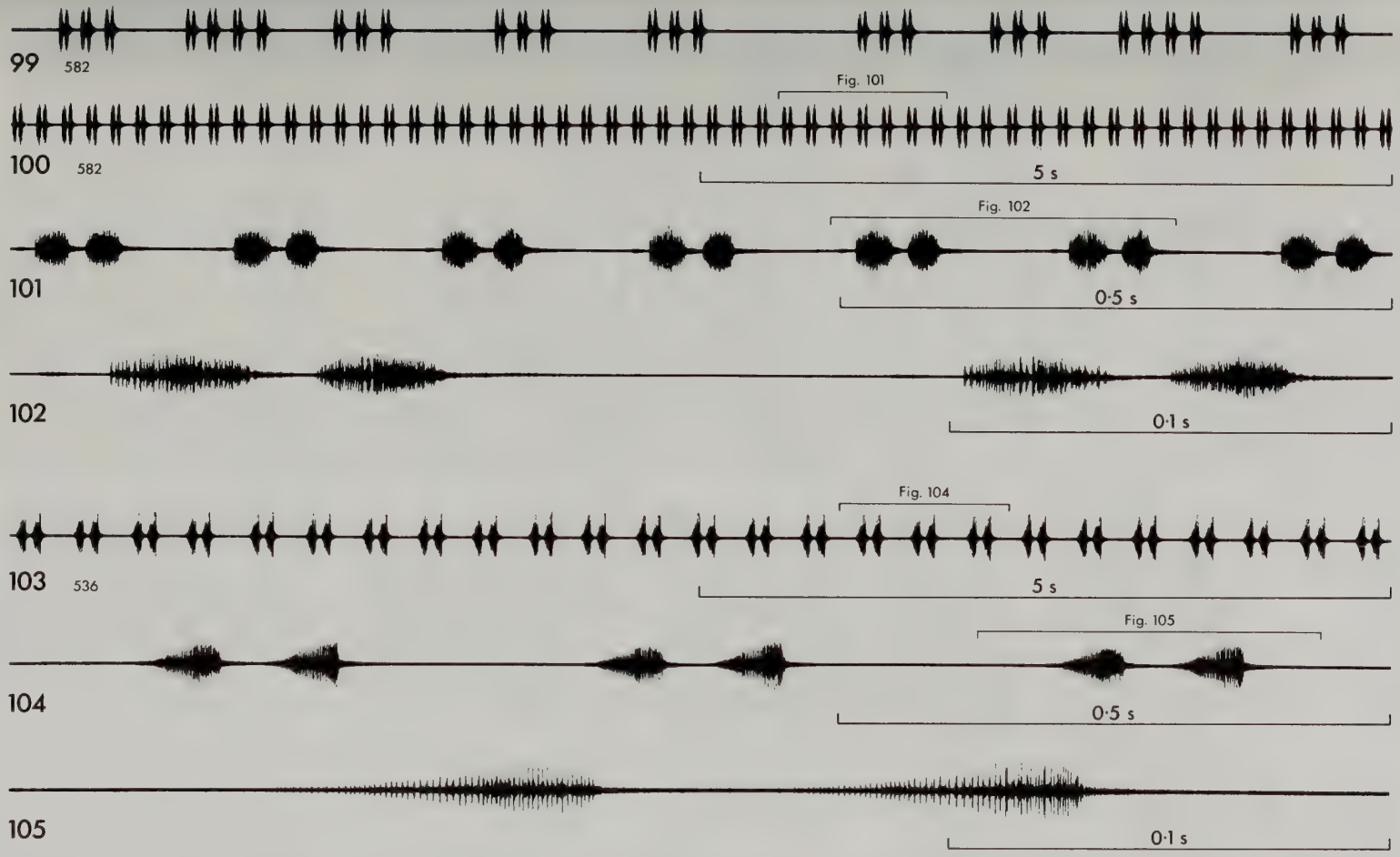
REFERENCES TO SONG. **Oscillogram**: Dubrovin & Zhantiev, 1970; Heller, 1988. **Frequency information**: Heller, 1988. **Musical notation**: Yersin, 1854*b*. **Verbal description only**: Chopard, 1922.

RECOGNITION. This species differs from all other western European species of *Platycleis* of comparable size in being brachypterous, the fore wings not reaching the tip of the abdomen. Females are also well characterized by the terminal abdominal sternites: both the sixth and seventh sternites have a bifid prominence and the subgenital plate is uniquely shaped (Fig. 25).

In the field males may be recognized by the calling song, which consists of disyllablic echemes repeated at the rate of more than 4/s and often grouped into short sequences of 2–4 echemes. The echemes of *intermedia* are also disyllabic, but are repeated less frequently than 4/s and are usually in long ungrouped sequences.

SONG. (Figs 99–102). The calling song consists of disyllabic echemes repeated at the rate of about 4–15/s, often grouped into short sequences of 2–4 echemes (Fig. 99) but sometimes in long sequences of indefinite duration (Fig. 100). Oscillographic analysis shows that the opening hemisyllables are often present (though always very quiet) and that the closing hemisyllables usually last about 10–50 ms. The duration of each echeme (excluding the first opening hemisyllable, when present) is about 45–100 ms and the intervals between the echemes (within a group or during long sequences) are usually about 60–130 ms. There are no microsyllables.

DISTRIBUTION. This species occurs in southern Europe from the Mediterranean coast of France



Figs 99–105 Oscillograms at three different speeds of the male calling song of (99–102) *Platycleis sepium* and (103–105) *P. intermedia*. Figs 99 and 100 were taken from the same male and show the two types of song-pattern produced by *P. sepium*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 2 (p. 3).

to the extreme south of European U.S.S.R., including the Italian and Balkan Peninsulas and Asia Minor. From Iberia there are only old records from Catalonia.

Platycleis tessellata (Charpentier)

(Figs 26, 33, 106, 107, 109, 110, 112, 113)

Locusta tessellata Charpentier, 1825: 121. Unknown number of syntypes, FRANCE: south, and PORTUGAL: 'Lusitania' (lost).

Platycleis (Tessellana) holoptera emrahi Koçak, 1984: 169. [Unnecessary replacement name for *Locusta tessellata* Charpentier (see p. 6).] **Syn. n.**

REFERENCES TO SONG. **Oscillogram**: Grein, 1984; Heller, 1988. **Diagram**: Duijm & Kruseman, 1983. **Frequency information**: Heller, 1988; Latimer & Broughton, 1984. **Verbal description only**: Chopard, 1922; Rentz, 1963. **Disc recording**: Grein, 1984.

RECOGNITION. Among the small western European species of *Platycleis*, *tessellata* may be distinguished from *montana* and *stricta* by the short, strongly curved ovipositor (Fig. 33) and modified seventh abdominal sternite (Fig. 26) of the female, and the male cerci, of which the inner tooth is nearer the tip than the base. Both sexes may be distinguished from *veyseli* by the fully developed wings.

Live males in captivity may be distinguished from all other species of *Platycleis* with overlapping distributions by the calling song, which consists of a series of quiet diplosyllables, sometimes repeated regularly at the rate of about 6–8/s but at other times less frequently and more irregularly. The calling song of *veyseli* seems to be identical, but as that species is absent from the whole of western Europe (qualifying for inclusion here only because of its occurrence in the extreme east of Austria) confusion between the songs of these two species is unlikely.

SONG. (Figs 106, 107, 109, 110, 112, 113). The calling song consists of a series of quiet diplosyllables, each lasting about 80–200 ms and composed of an opening hemisyllable lasting about 12–50 ms and a closing hemisyllable lasting about 30–130 ms. The syllables are sometimes repeated regularly at the rate of about 6–8/s for long periods of a minute or more (Fig. 106), but at other times they are repeated much less frequently (about 1–4/s) and less regularly (Fig. 107). Sometimes they are grouped into rather loose echemes of very variable duration. The intervals between syllables vary from about 30–100 ms when they are repeated regularly to about 0·1–1·0 s or more when the repetition rate is irregular. There are no microsyllables.

DISTRIBUTION. Widespread in the western Mediterranean Region (including North Africa), extending northwards to central France and southern Germany, and eastwards to southern U.S.S.R. and Asia Minor, but not occurring in Austria or the southern part of the Balkan Peninsula. Introduced into California, U.S.A.

Platycleis veyseli Koçak

(Figs 108, 111, 114)

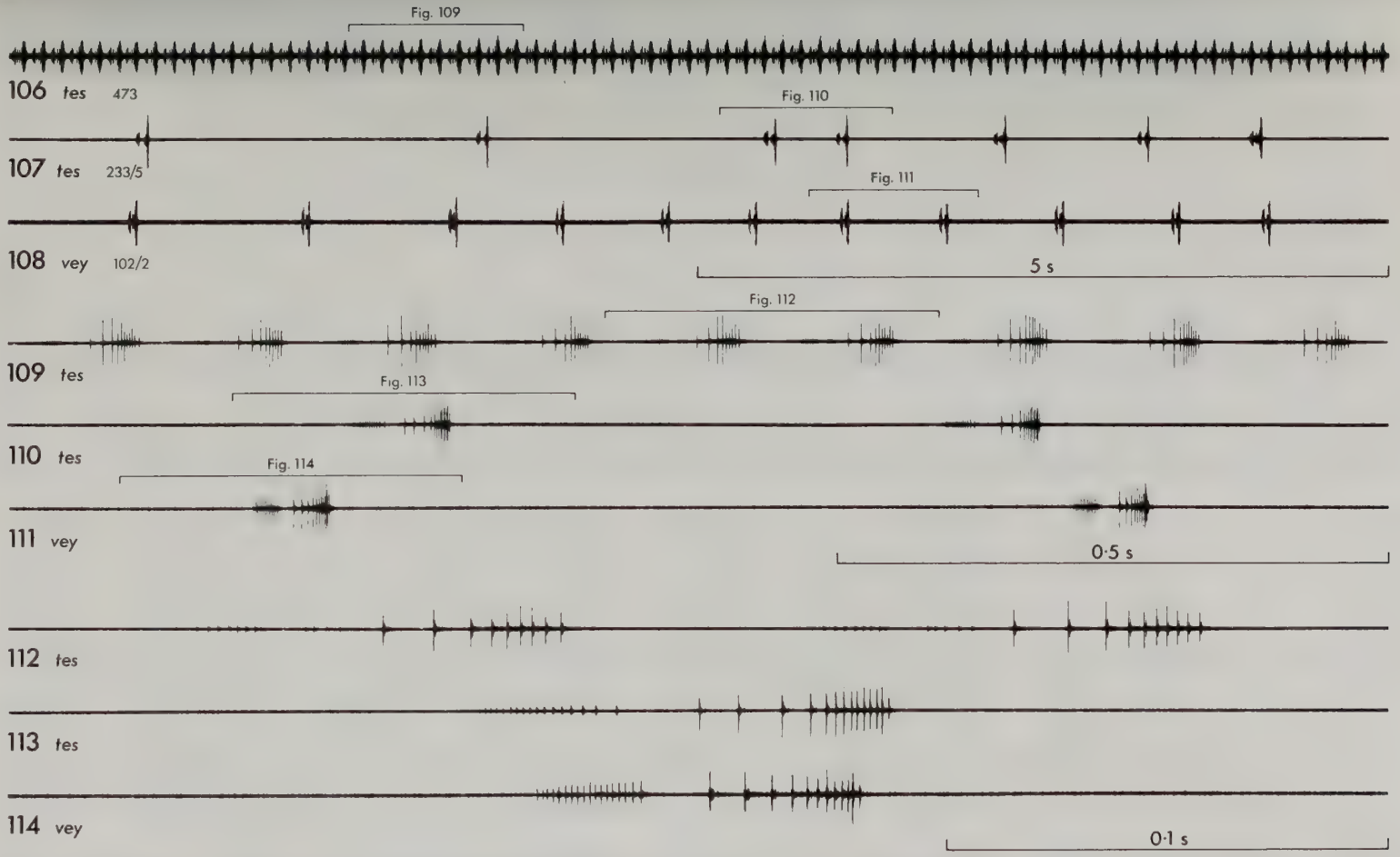
Locusta vittata Charpentier, 1825: 115. Type(s), HUNGARY (lost) [one female putative type specimen in MNHU, Berlin examined]. [Primary homonym of *Locusta vittata* Thunberg, 1789: 102.]

Platycleis (Tessellana) veyseli Koçak, 1984: 169. [Replacement name for *Locusta vittata* Charpentier.]

REFERENCES TO SONG. **Oscillogram**: Heller, 1988 (as *vittata*); Schmidt & Schach, 1978 (as *vit.*). **Frequency information**: Heller, 1988 (as *vit.*). **Verbal description only**: Harz, 1962 (as *vit.*).

RECOGNITION. This species may be distinguished from the other small species of *Platycleis* occurring in western Europe by its reduced wings, the fore wings not reaching the tip of the abdomen and the hind wings not reaching the tips of the fore wings. The calling song, consisting of a series of quiet diplosyllables, enables live males in captivity to be distinguished from all other species of *Platycleis* with overlapping distributions. The calling song of *tessellata* seems to be identical, but confusion is unlikely in practice as the distributions of the two species do not overlap in western Europe.

SONG. Figs 108, 111, 114). The calling song consists of a series of quiet diplosyllables, each lasting about 60–80 ms and composed of an opening hemisyllable lasting about 20–25 ms and a closing hemisyllable lasting about 25–35 ms. In the song of the single male studied (in dim light at an air temperature of 26°C) the syllables were grouped into loose echemes of 7–16 syllables, during which the syllable repetition rate averaged about 1/s and the syllables were separated by intervals of about 0·4–1·6 s. It is likely that the study of further males under varying conditions would show that the song varies in the same way as that of *tessellata* (p. 000). There are no microsyllables.



Figs 106–114 Oscillograms at three different speeds of the male calling song of (106, 107, 109, 110, 112, 113) *Platycleis tessellata* and (108, 111, 114) *P. veyseli*. Figs 106 and 107 show the two types of song-pattern produced by *P. tessellata*; it is likely that *P. veyseli* also sometimes produces the continuous type of song shown in Fig. 106. The small numbers following the name abbreviations refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 2 (p. 3).

DISTRIBUTION. In the area studied *veyseli* occurs only in the extreme east of Austria; elsewhere its range extends through south-east Europe (but not the southern part of the Balkan Peninsula) to southern U.S.S.R. and Iran.

Platycleis montana (Kollar)

(Figs 15, 27, 34, 115–120)

Locusta montana Kollar, 1833: 79. Holotype ♀, AUSTRIA: near Vienna, Mödling (NM, Vienna) [examined].

REFERENCES TO SONG. **Oscillogram**: Heller, 1988. **Diagram**: Bellmann, 1985*a*. **Cassette recording**: Bellmann, 1985*b*.

RECOGNITION. This species may be distinguished from *tessellata* and *veyseli* by the long, gently curved ovipositor (Fig. 34) and unmodified seventh abdominal sternite of the female, and the male cerci, of which the inner tooth is nearer the base than the tip. Females may be distinguished from the related species *stricta* by the truncate subgenital plate (Fig. 27) and males by the shape of the tenth abdominal tergite (Fig. 15).

Live males in captivity may be recognized by the calling song, which consists of a series of quiet echemes, each lasting about 1–2 s, sometimes repeated regularly at the rate of one every 3–4 s but at other times less frequently and more irregularly.

SONG. (Figs 115–120). The calling song consists of a series of quiet echemes, each lasting about 1–2 s, sometimes repeated regularly at the rate of one every 3–4 s but at other times less frequently and more irregularly. Oscillographic analysis shows each echeme to consist of about 60–140 alternately quieter and louder closing hemisyllables following one another at the rate of about 40–70/s. The quieter closing hemisyllables last about 4–11 ms and the louder ones about 7–17 ms; opening hemisyllables, always quieter than the closing hemisyllables, are often also present. The echemes are usually quieter at the beginning, reaching maximum intensity after about 10–20 syllables. Sometimes the echemes end in a series of loud closing syllables without the interposition of quieter ones (Figs 118, 120), and occasionally there are two quieter closing hemisyllables between two consecutive louder ones. There are no microsyllables.

DISTRIBUTION. This primarily eastern European species occurs in Germany (very locally), eastern Austria, Yugoslavia, Hungary and eastwards to central Asia.

Platycleis stricta (Zeller)

(Figs 16, 28, 35, 121–125)

Decticus strictus Zeller, 1849: 116. Holotype ♀, ITALY: near Rome, Via Appia (NM, Vienna) [examined].

REFERENCES TO SONG. **Oscillogram**: Heller, 1988.

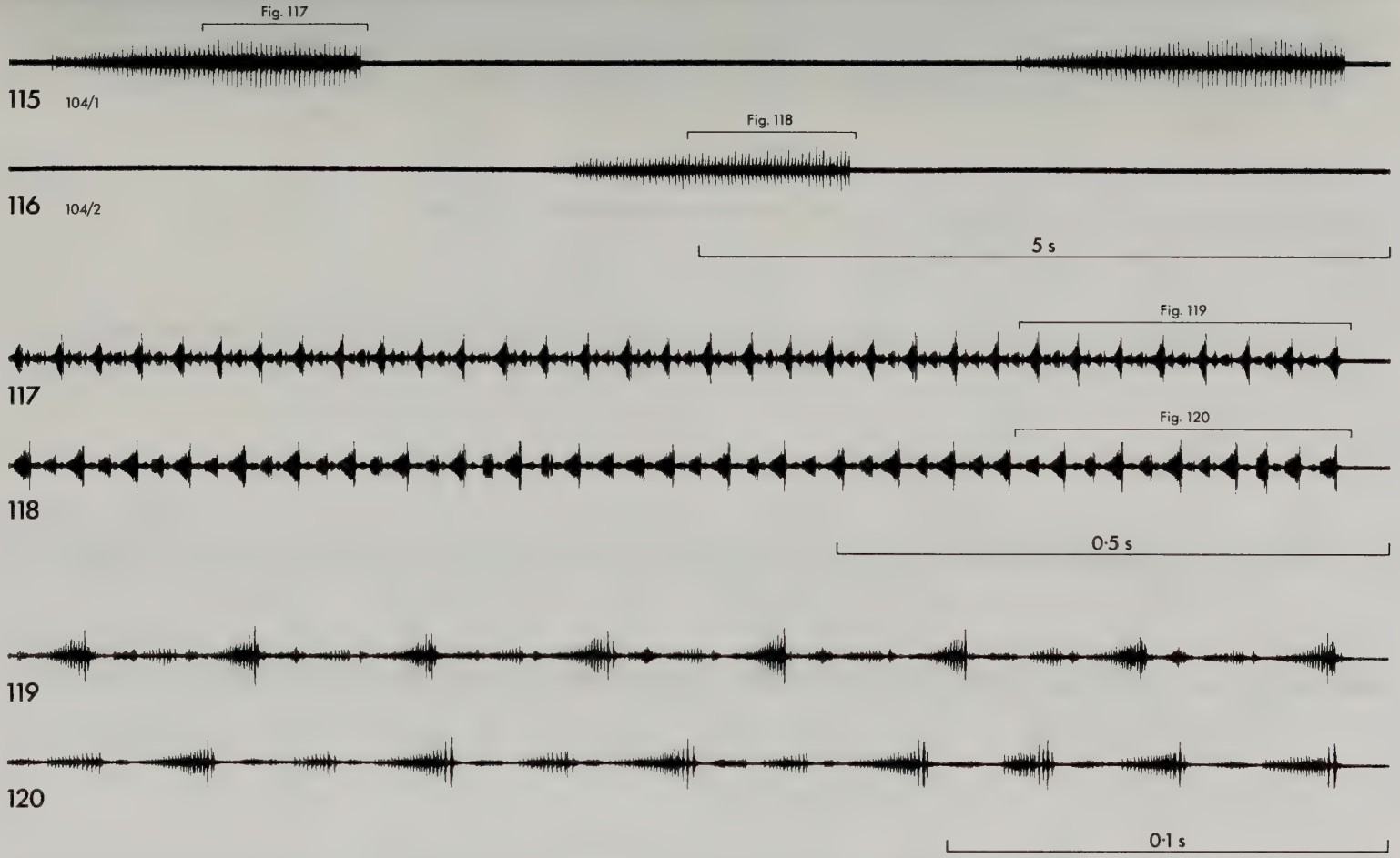
RECOGNITION. Like *montana*, this species may be distinguished from *tessellata* and *veyseli* by the long, gently curved ovipositor (Fig. 35) and unmodified seventh abdominal sternite of the female, and the male cerci, of which the inner tooth is nearer the base than the tip. Females may be distinguished from *montana* by the bilobed subgenital plate (Fig. 28), and males by the shape of the tenth abdominal tergite (Fig. 16).

A stationary live male in captivity may be recognized by the calling song, which consists of a long series of short echemes interspersed with much longer ones.

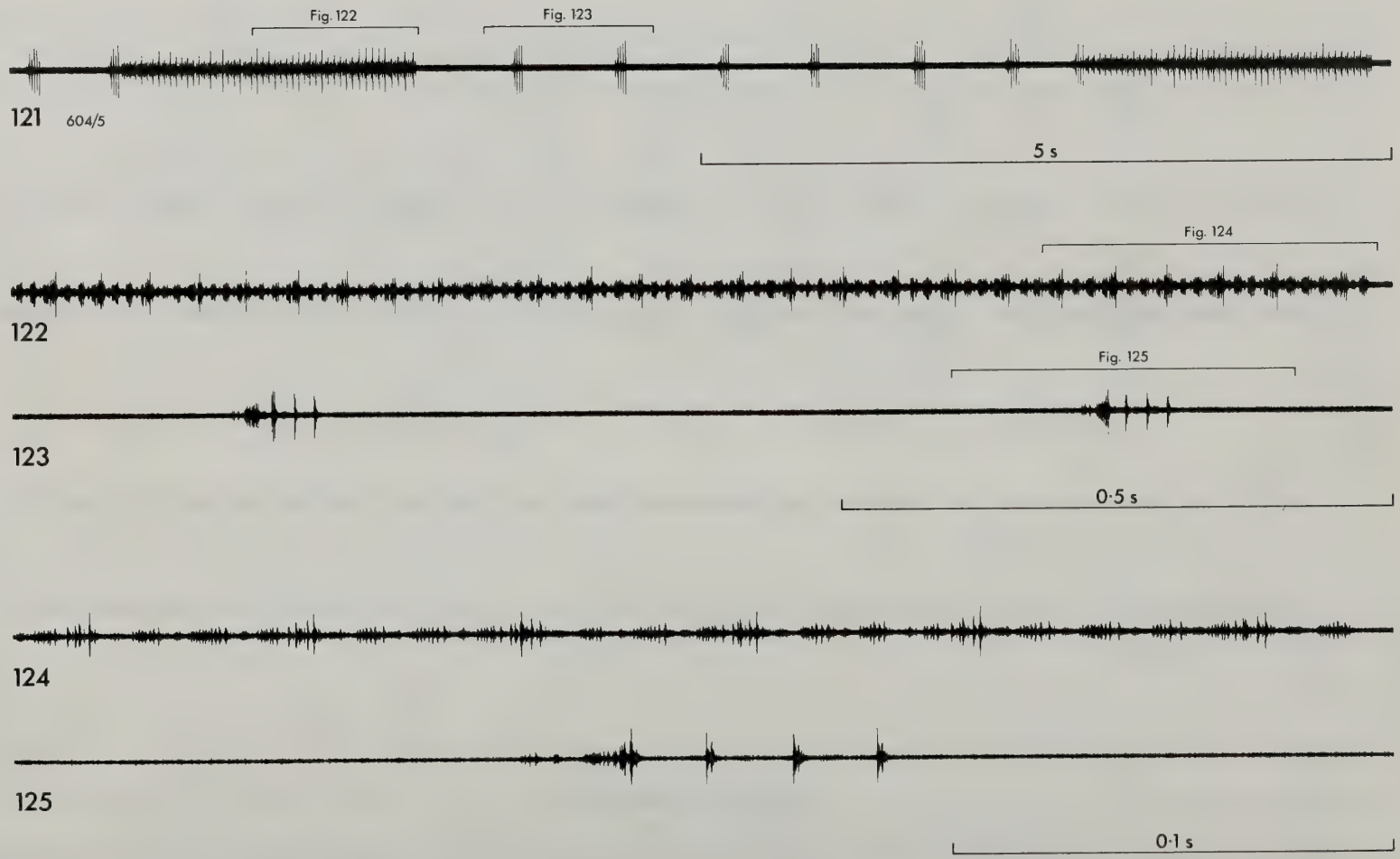
SONG. Figs 121–125). The fully developed calling song from a stationary male consists of short echemes interspersed with much longer ones and often continues for several minutes. There are about 4–7 short echemes, repeated at intervals of about 0·3–1·2 s, between successive longer echemes; the short echemes last about 50–100 ms and the longer ones about 1–2 s. Oscillographic analysis shows that the short echemes consist of a macrosyllable lasting about 20–30 ms followed by a series of about 3–4 microsyllables, each lasting about 1–5 ms and repeated at the rate of about 50–55/s. The longer echemes follow immediately after a short echeme of this type and consist of a dense sequence of about 90–170 macrosyllables repeated at the rate of about 60–90/s. The syllables in these larger echemes are in groups of three (occasionally four) in which the first one is the quietest and shortest (lasting about 8–12 ms) and the last one the loudest and longest (lasting about 15–20 ms); each group lasts about 40–45 ms and the groups follow one another without any intervening pauses. Opening hemisyllables, always quieter than the closing hemisyllables, are usually present in both the shorter and longer echemes (and are included in the syllable durations given above). There are often small groups of microsyllables interrupting the regular flow of the longer echemes.

While singing males are moving they generally produce only the short echemes.

DISTRIBUTION. Widespread in Italy and also recorded from Sardinia, the Yugoslavian coast, Bulgaria and the Ukraine.



Figs 115–120 Oscillograms at three different speeds of the calling songs of two males of *Platycleis montana*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 2 (p. 3).



Figs 121–125 Oscillograms at three different speeds of the male calling song of *Platycleis stricta*. The small numbers following the figure numbers refer to the recordings from which the oscillograms were made and can be used to obtain the full data from Table 2 (p. 3).

Acknowledgements. I am much indebted to Drs U. Aspöck, M. Donskoff and K. K. Günther, who have kindly lent me type specimens or other material from their respective institutions, and to Professor M. J. Samways, who kindly gave me a tape recording of the song of *P. falx* made by him in southern France. I should also like to thank Mr D. Elias, who kindly provided me with live males of *P. albopunctata* from the Gower Peninsula, South Wales; Dr W. Latimer, who was kind enough to bring me live males of *P. albopunctata*, *P. sabulosa* and *P. tessellata* from central Spain, and of *P. sepium* from Yugoslavia; and Mr B. C. Townsend, who kindly collected live males of *P. albopunctata* for me from Jersey.

I am particularly grateful to my colleague Mr W. J. Reynolds, who made a number of the song recordings used in this study, helped me in reviewing the past literature on the songs, tested the identification key based on morphological characters and provided valuable comments at various stages in the preparation of the paper.

Finally I wish to thank my wife, who has given me invaluable help in all my field-work.

REFERENCES

Ahlén, I. 1981. Ultraljud hos svenska vårtbitare. *Entomologisk Tidskrift* **102:** 27–41.

—— 1982. *Songs of Swedish bush crickets (Orth., Tettigoniidae). Ultrasonics transformed to audible sounds*. Tape cassette. Uppsala (Swedish University of Agricultural Sciences).

Azam, [J.] 1901. Catalogue synonymique et systématique des orthoptères de France [fourth part]. *Miscellanea Entomologica* **9:** 97–112.

Baier, L. J. 1930. Contribution to the physiology of the stridulation and hearing of insects. *Zoologische Jahrbücher* (Zoologie und Physiologie) **47:** 151–248.

Bei-Bienko, G. Ya. 1951. Studies on the bush-crickets of the U.S.S.R. and neighbouring countries. *Trudy Vsesoyuznogo Entomologicheskogo Obshchestva* **43:** 129–170. [In Russian.]

Bellmann, H. 1985*a*. *Heuschrecken. Beobachten, bestimmen*. 210 pp. Melsungen.

—— 1985*b*. *Die Stimmen der heimischen Heuschrecken*. Tape cassette. Melsungen (Neumann-Neudamm).

Broughton, W. B. 1955. Notes sur quelques caractères acoustiques de *Platycleis affinis* Fieber (Tettigoniidae) [pp. 201–247]. *In* Busnel, R.-G. [Ed.], Colloque sur l'acoustique des Orthoptères. *Annales des Epiphyties*, fascicule spécial de 1954, 448 pp.

—— 1964. Glossarial index [pp. 824–910]. *In* Busnel, R.-G. [Ed.], *Acoustic behaviour of animals*. xx + 933 pp. Amsterdam, London & New York.

—— 1965. Song learning among grasshoppers? *New Scientist* **27:** 338–341.

—— 1972. The grasshopper and the taxonomer. III. Keys to the species. *Journal of Biological Education* **6:** 385–395.

Broughton, W. [B.] & Lewis, [D.] B. 1979. Insect sound research at the Animal Acoustics Unit, City of London Polytechnic. *Recorded Sound* **74–75:** 77–80.

Broughton, W. B., Samways, M. J. & Lewis, D. B. 1975. Low-frequency sounds in non-resonant songs of some bush crickets (Orthoptera, Tettigonioidea). *Entomologia Experimentalis et Applicata* **18:** 44–54.

Burton, J. F. & Ragge, D. R. 1987. *Sound guide to the grasshoppers and allied insects of Great Britain and Ireland*. Tape cassette. Colchester (Harley Books).

Busnel, R.-G. 1955. Sur certains rapports entre le moyen d'information acoustique et le comportement acoustique des Orthoptères [pp. 281–306]. *In* Busnel, R.-G. [Ed.], Colloque sur l'acoustique des Orthoptères. *Annales des Epiphyties*, fascicule spécial de 1954, 448 pp.

Caudell, A. N. 1908. Orthoptera, fam. Locustidæ, subfam. Decticinæ. *Genera Insectorum* **72**, 43 pp.

Charpentier, T. de 1825. *Horae entomologicae, adjectis tabulis novem coloratis*. xvi + 262 pp. Bratislava.

Chopard, L. 1922. Orthoptères et Dermaptères. *Faune de France* **3**, vi + 212 pp.

—— 1952. Orthoptéroïdes. *Faune de France* **56** (1951), 359 pp.

Defaut, B. 1987. *Recherches cénotiques et bioclimatiques sur les Orthoptères en région ouest paléarctique*. Toulouse (doctoral thesis). xiv + 509 pp.

Drury, D. 1773. *Illustrations of natural history* **2**, vii + 92 pp. London.

Dubrovin, N. N. & Zhantiev, R. D. 1970. Acoustic signals of katydids (Orthoptera, Tettigoniidae). *Zoologicheskii Zhurnal* **49:** 1001–1014. [In Russian with English summary.]

Duijm, M. & Kruseman, G. 1983. *De Krekels en Sprinkhanen in de Benelux*. 186 pp. Amsterdam.

Elsner, N. & Popov, A. V. 1978. Neuroethology of acoustic communication. *Advances in Insect Physiology* **13:** 229–355.

Faber, A. 1928. Die Bestimmung der deutschen Geradflügler (Orthopteren) nach ihren Lautäusserung. *Zeitschrift für Wissenschaftliche Insektenbiologie* **23:** 209–234.

Fabricius, J. C. 1775. *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus*. [xxxii +] 832 pp. Flensburg & Leipzig.

Fieber, F. X. 1853. Synopsis der europäischen Orthoptera [fourth part]. *Lotos* **3:** 168–176.

Fulton, B. B. 1932. North Carolina's singing Orthoptera. *Journal of the Elisha Mitchell Scientific Society* **47:** 55–69.

Goeze, J. A. E. 1778. *Entomologische Beyträge zu des Ritter Linné zwölften Ausgabe des Natursystems* **2**, lxxii + 352 pp. Leipzig.

Gould, [J.] 1836. [Characters of some new species of birds belonging to the genera *Tamatia* and *Cursorius*.] *Proceedings of the Zoological Society of London* **1836:** 80–81.

Grein, G. 1984. *Gesänge der heimischen Heuschrecken. Akustisch-optische Bestimmungshilfe*. 30 cm disc, 33 rpm [with oscillograms]. Hannover (Niedersächsisches Landesverwaltungsamt).

Harz, K. 1957. *Die Geradflügler Mitteleuropas*. xxiv + 494 pp. Jena.

—— 1962. Orthopterologische Beiträge IV (Schluß). *Nachrichtenblatt der Bayerischen Entomologen* **11:** 65-69.

—— 1969. Die Orthopteren Europas I. *Series Entomologica* **5**, xx + 749 pp.

Heller, K.-G. 1988. Bioakustik der europäischen Laubheuschrecken. *Ökologie in Forschung und Anwendung* **1**, 358 pp.

Holst, K. T. 1970. Kakerlakker, Græshopper og Ørentviste XXVII. *Danmarks Fauna* **79**, 221 pp.

Ingrisch, S. 1981. Bemerkenswerte Orthopterenfunde aus Nordgriechenland und aus Istrien. *Nachrichtenblatt der Bayerischen Entomologen* **30:** 87–91.

Kaltenbach, A. 1964. Zur Taxonomie und Synonymie des *Platycleis-grisea*-Artenkreises. *Annalen des Naturhistorischen Museums in Wien* **67:** 439–442.

Kelch, [A.] 1852. Grundlage zur Kenntniss der Orthopteren (Gradflügler [sic]) Oberschlesiens [pp. 1–6]. *In*: *Zu der öffentlichen Prüfung aller Klassen des Königlichen Gymnasiums zu*

Ratibor und der Entlassung der Arbiturienten den 5. und 6. April ladet ergebenst ein das Lehrer-Collegium [1851–1852]. [vi +] 30 pp. Ratibor.

Kirby, W. F. 1906. *A synonymic catalogue of Orthoptera. Vol. II. Orthoptera Saltatoria. Part I. (Achetidæ et Phasgonuridæ.)* viii + 562 pp. London.

Koçak, A. Ö. 1984. On the nomenclatural status of two species group names in Orthoptera. *Priamus* **3:** 169–170.

Kollar, V. 1833. Systematisches Verzeichniss der im Erzherzogthume Oesterreich vorkommenden geradflügeligen Insekten. *Beiträge zur Landeskunde Oesterreich's unter der Enns* **3:** 67–87.

Kruseman, G. 1989. Materiaux pour la faunistique des Orthoptères de France. Fascicule III. Les Ensifères et des Caelifères: les Tridactyloides et les Tétrigoides des Musées de Paris et d'Amsterdam. *Verslagen en Technische Gegevens, Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Universiteit van Amsterdam* **51**, xix + 164 pp.

Latimer, W. 1981*a*. Acoustic competition in bush crickets. *Ecological Entomology* **6:** 35–45.

—— 1981*b*. Variation in the song of the bush cricket *Platycleis albopunctata* (Orthoptera, Tettigoniidae). *Journal of Natural History* **15:** 245–263.

—— 1981*c*. The acoustic behaviour of *Platycleis albopunctata* (Goeze) (Orthoptera, Tettigoniidae). *Behaviour* **76:** 182–206.

Latimer, W. & Broughton, W. B. 1984. Acoustic interference in bush crickets; a factor in the evolution of singing insects? *Journal of Natural History* **18:** 599–616.

Lewis, D. B. 1974. The physiology of the Tettigoniid ear. IV. A new hypothesis for acoustic orientation behaviour. *Journal of Experimental Biology* **60:** 861–869.

Lewis, D. B., Seymour, C. & Broughton, W. B. 1975. The response characteristics of the tympanal organs of two species of bush cricket and some studies of the problem of sound transmission. *Journal of Comparative Physiology* **104:** 325–351.

Messina, A., Arcidiacono, R., Failla, M. C., Lombardo, C. & Lombardo, F. 1980. Canto di richiamo in *Platycleis intermedia intermedia (Serv.) di Sicilia (Orthoptera, Decticinae). Animalia* **7:** 117–121.

Miram, E. F. 1935. Blattodea, Mantodea, Phasmodea and Orthoptera of Tadzhikistan. *Trudy Tadzhikskoi Bazy, Akademiya Nauk SSSR* **5:** 219–236. [In Russian.]

Pinedo, C. 1985. Contribucion al estudio del comportamiento acustico del Tetigonido *Platycleis intermedia* (Serville). *Actas do II Congresso Ibérico de Entomologia (Boletim da Sociedade Portuguesa de Entomologia*, Suplemento 1) **2:** 27–36.

Ragge, D. R. 1965. *Grasshoppers, crickets and cockroaches of the British Isles*. xii + 299 pp. London & New York.

—— 1986. The songs of the western European grasshoppers of the genus *Omocestus* in relation to their taxonomy (Orthoptera: Acrididae). *Bulletin of the British Museum (Natural History)* (Entomology) **53:** 213–249.

Ragge, D. R., Burton, J. F. & Wade, G. F. 1965. *Songs of the British grasshoppers and crickets*. 17 cm disc, 33 rpm. London (Warne).

Ramme, W. 1927. Die Dermapteren und Orthopteren Siziliens und Kretas. *Eos* **3:** 111–200.

—— 1951. Zur Systematik Faunistik und Biologie der Orthopteren von Südost-Europa und Vorderasien. *Mitteilungen aus dem Zoologisches Museum in Berlin* **27:** 1–432.

Rentz, D. C. 1963. Additional records of *Platycleis tessellata* (Charpentier) in California with biological notes (Orthoptera: Tettigoniidae). *Pan-Pacific Entomologist* **39:** 252–254.

Rösel von Rosenhof, A. J. 1749. *Insecten-Belustigung* **2** (seventh part: Heuschrecken und Grillen), 200 pp. Nürnberg.

Sales, G. [D.] & Pye, [J.] D. 1974. *Ultrasonic communication by animals*. xi + 281 pp. London.

Samways, M. J. 1976*a*. Song modification in the Orthoptera. I. Proclamation songs of *Platycleis* spp. (Tettigoniidae). *Physiological Entomology* **1:** 131–149.

—— 1976*b*. Song modification in the Orthoptera. III. Microsyllabic echemes in *Platycleis* spp. (Tettigoniidae). *Physiological Entomology* **1** 299–303.

—— 1976*c*. Habitats and song of the five species of *Platycleis* (sensu stricto) (Tettigoniidae) from Montpellier, Hérault, southern France [pp. 334–335]. *In* Harz, K., Die Orthopteren Europas III. *Series Entomologica* **12**, 434 pp.

—— 1976*d*. Effect of vegetation noise on the song behaviour of *Platycleis intermedia* (Orthoptera, Tettigoniidae). *Biophon* **4** (3): 4–8.

—— 1977. Song modification in the Orthoptera. IV. The *Platycleis intermedia*/*P. affinis* interaction quantified. *Physiological Entomology* **2:** 301–315.

Samways, M. J. & Broughton, W. B. 1976. Song modification in the Orthoptera II. Types of acoustic interaction between *Platycleis intermedia* and other species of the genus (Tettigoniidae). *Physiological Entomology* **1:** 287–297.

Sarra, R. 1934. Notizie biologiche della *Platycleis grisea* F. (Orth. – Phasgonuridae). *Bollettino del Laboratoria di Zoologia Generale e Agraria del R. Istituto Superiore Agrario in Portici* **27:** 197–209.

Schmidt, G. H. & Schach, G. 1978. Biotopmässige Verteilung, Vergesellschaftung und Stridulation der Saltatorien in der Umgebung des Neusiedlersees. *Zoologische Beiträge* (N.F.) **24:** 201–308.

Scudder, S. H. 1867. Notes on the stridulation of some New England Orthoptera. *Proceedings of the Boston Society of Natural History* **11:** 306–313.

—— 1868. The songs of the grasshoppers. *American Naturalist* **2:** 113–120.

—— 1893. The songs of our grasshoppers and crickets. *Report of the Entomological Society of Ontario* **1892:** 62–78.

Serville, J. G. A. 1838. *Histoire naturelle des insectes. Orthoptères*. xviii + 776 pp. Paris.

Thunberg, C. P. 1789. *Dissertatio entomologica novas insectorum species sistens* **5**, pp. [ii +] 85–106. Uppsala.

Uvarov, B. P. 1930. Notes on new or less-known Holarctic Decticinae (Orthoptera, Tettigoniidae). *Annals and Magazine of Natural History* (10) **5:** 400–405.

Walker, F. 1869. *Catalogue of the specimens of Dermaptera Saltatoria and supplement to the Blattariæ in the collection of the British Museum*. [iv +] 224 pp. London.

Wallin, L. 1979. *Svenska gräshoppors och vårtbitares sånglåten*. 9 pp. Uppsala. [With tape cassette of recorded songs.]

Wesmael, C. 1838. Enumeratio methodica Orthopterorum Belgii. *Bulletins de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles* **5:** 587–597.

Yersin, [A.] 1854*a*. Sur quelques Orthoptères nouveaux ou peu connus, du midi de la France. *Bulletins des Séances de la Société Vaudoise des Sciences Naturelles* **4:** 63–70.

—— 1854*b*. Mémoire sur quelques faits relatifs à la stridulation des Orthoptères et à leur distribution géographique en Europe. *Bulletins des Séances de la Société Vaudoise des Sciences Naturelles* **4:** 108–128.

—— 1857. Sur les Orthoptères et quelques Hémiptères des environs d'Hyères en Provence. *Annales de la Société Entomologique de France* (3) **4:** 737–748.

Zeller, P. C. 1849. Ueber *Decticus tessellatus* Charp., *D. Philippicus* Zell. und *D. strictus* Zell. *Entomologische Zeitung herausgegeben von dem entomologischen Vereine zu Stettin* **10:** 113–116.

Zeuner, F. E. 1940. The Orthoptera Saltatoria of Jersey, Channel Islands. *Proceedings of the Royal Entomological Society of London* (B) **9:** 105–110.

—— 1941. The classification of the Decticinae hitherto included in *Platycleis* Fieb. or *Metrioptera* Wesm. (Orthoptera, Saltatoria). *Transactions of the Royal Entomological Society of London* **91:** 1–50.

Zhantiev, R. D. & Dubrovin, N. N. 1971. On the sensitivity of tympanal organs of katydids (Orthoptera, Tettigoniidae) to sounds of different frequencies. *Proceedings of the XIII International Congress of Entomology, Moscow, 2–9 August, 1968* **2:** 45–46.

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Bull. Br. Mus. nat. Hist. (Ent.) **59**(1): 37–115 Issued 28 June 1990

A reclassification of the *Melanotus* group of genera (Coleoptera: Elateridae)

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SYNOPSIS. The character states at present employed to define the genera of the *Melanotus* group are reviewed and evaluated and the value of previously neglected and new characters and character states discussed. Those characters for which it has proved possible to define discrete character states are included in a DELTA-format data file prepared for use with the Dallwitz/Pankhurst key-generating, description-writing and online interactive identification (expert) programs. An edited computer-generated key to genera and edited computer-generated generic diagnoses are presented. Annotated lists of the species examined and notes on other species are included.

One species is removed from the group and a new monobasic genus is established for a new species. A long-disregarded generic name is restored to take the place of an unnecessary replacement name. Nine generic names are newly placed in synonymy. One combination is restored, 57 new combinations and 4 new names for junior homonyms are proposed. Four taxa are restored to specific status.

The Appendix contains notes and comments on the 'Pankey package' of programs used

in the course of this work, the DELTA-format input file employed and the keys produced in an edited numerical-format.

A key to Elaterid genera with pectinate claws is included in the Appendix.

The references contain information on the dates of publication of several works which until now have been wrongly cited. The geographical position of several type and other localities has been established.

Throughout this work a number preceded by a # refers to a character or character-state and a number commencing in a 0 to a species included in the DELTA-format file reproduced on pp. 92–98.

INTRODUCTION

The genera considered in this work are, with one exception (*Jonthadocerus* see p. 88), those included in the Elaterid subfamily Melanotinae by the Schenkling (1927: [265]–290) catalogue or subsequently assigned to a family-group taxon based on *Melanotus*.

The family-group was established (as the subtribe Mélanotites) by Candèze (1860: 179) whose short diagnosis 'frons carinate, pro[noto]sternal suture concave [= lateral margins of prosternum emarginate, Figs 18–22] and grooved or simple [anteriorly], posterior coxal plates narrowing gradually from the mid line to the lateral margins, scutellum not cordate, claws always pectinate' has, in all essentials, remained unchanged until now. Stibick's (1979(v): 179) belief that the structure of the mesocoxal cavity is constant is found to have been mistaken (p. 48). To the practised eye the included species have a distinctive appearance and workers do not seem to have had any difficulty in attributing taxa to the family group. However, a study of the Elateridae on a world-wide basis has shown that Candèze's diagnosis does not always distinguish the *Melanotus* group from all other genera with pectinate claws. A key to family-group taxa and genera with pectinate or serrate claws, in which a previously unnoticed character is employed, will be found in the Appendix (p. 101).

The proposed new diagnosis of the *Melanotus* group is as follows: supra-antenal carinae confluent in the mid line, forming a carina which is entirely separate from the anterior margin of the head (= line of articulation of the labrum), mandibles with a single tooth on the blade, prosternum without an impunctate or almost impunctate border in the anterior half of its length, mese imeron always forming part of the mesocoxal cavity, mesotrochantin visible and claws pectinate.

Representatives of the group have been recorded from all parts of the world except New Zealand. The adults are between 5–20 mm in length though the majority are 10–14 mm. Most species are yellow-brown, red-brown, dark brown or black. In some species the head, prothorax, elytra and abdomen may be of different colours within this range and in a few the pronotum or elytra display regular but variable markings. In a very small number of species the prothorax is red and the head and elytra black, a combination of colours not uncommon in the Elateridae. The adults are found on the ground, under bark and also on the flowers and foliage of plants and trees. They are able to fly and are attracted to light. The larvae live in decaying wood and in the ground.

The group is of some economic importance as the larvae of a number of *Melanotus* species are known to cause damage to the roots of cereal, forage and other crops (see p. 60).

In the course of trial runs of Pankhurst's key-generating program (see Dallwitz & Paine, 1986: 105) using part of a larger DELTA-format (*op. cit.*) data file, it became increasingly evident that the limits of some of the genera included in the *Melanotus* group are so poorly defined that it is impossible to make clear-cut distinctions between them when the group is considered on a world-wide basis. The large DELTA-format data file is being prepared in the expectation that it will eventually prove possible to produce a computer-generated key to the genera of the Elateridae. The data for this file, which is updated whenever the opportunity arises, are obtained by examination of the type species and, whenever possible, the type material of the type species of genera and subgenera. The data file also includes many species which display a combination of character states which do not correspond with those of the type species or which display previously unrecorded characters and/or character states.

The main reason why the unsatisfactory state of affairs described above has not become apparent before is that workers have restricted their studies to artificially circumscribed areas (countries or states) or to one geographical region. By so doing they have remained unaware that many of the classic character states, traditionally regarded as of prime importance at generic rank, are not

constant and frequently merge imperceptibly into one another, and also that the various states of different characters appear in a much larger range of combinations than they thought. The probability that the characters occur in an even greater range of combinations than are recorded in this work is indicated by the author's discovery, shortly before the completion of the preparatory studies for this paper, that in *Priopus* (previously *Neodiploconus*) *boninensis* (Van Zwaluwenburg)(038, p. 80), in which the posterior margin of the pronotum lacks lateral incisions and the inner margin of the hypomeron is without a well-defined border, the posterior angles of the pronotum are truncate when viewed from below. This combination of what, up to that moment, the author had believed were two of the main diagnostic characteristics of *Priopus* and one of *Melanotus* has further decreased the known number of characters separating the two genera. For the present *boninensis* is retained in *Priopus* (see p. 80).

The difficulty of interpreting many descriptions has also contributed to the confusion. Because accurate unambiguous diagnoses of taxa are difficult to produce, many descriptions take the form of comparisons with previously described taxa or the author's interpretation of them. As every worker's interpretation of a character or taxon is subjective, strongly influenced by his or her knowledge and experience of the group and by the appearance of the last specimen examined, these descriptions are often very misleading and the majority are more noteworthy for the information which is omitted than for that which is included. Experience has shown that it is not safe to assume that because a species is attributed to a particular genus it necessarily possesses the diagnostic features of that genus. Furthermore, little or no effort has been made to discover new characters and evaluate the states in which they appear. Where a new character (or more accurately, character state) has been found its discoverer has rarely, if ever, considered it necessary to examine other species for its presence before employing it as the diagnostic feature of a new taxon of generic or even higher rank. On other occasions the diagnoses of extant genera have been modified to include the newly discovered character state without first ascertaining whether the type species possesses the feature in question. Not surprisingly these activities have led to the establishment of what can best be described as a series of interlocking taxa at both the genus- and family-group rank.

This study does not claim to be exhaustive. As the offshoot of a much larger project, namely a computer-generated key to the genera of the Elateridae, its main aim is to provide a practical means of assigning species to well-defined genus-group taxa. I hope that it will also serve as a source of information on such diverse subjects as characters of taxonomic importance and the states in which they occur, the dates of publication of several relevant works and also as a sound foundation on which a more comprehensive work can be based. I have intentionally refrained from any comment on the phylogenetic relationship of the genera treated in this work. I am convinced that in our present state of knowledge of the family any such attempt would be premature and be no more than an entertaining intellectual exercise.

THE RANK OF THE *MELANOTUS* GROUP AND THE GENERA INCLUDED IN IT

There is some disagreement concerning the rank of the family-group taxon based on *Melanotus*. The Schenkling (1927) catalogue, the most recent work on the classification of the family (Stibick, 1979(v)), and many workers, including those interested in the Palaearctic (Leseigneur, 1972; Rudolph, 1974; Lohse, 1979), Indomalayan (Fleutiaux, 1941) and Nearctic faunas (Arnett, 1962; Blackwelder, 1974), treat the group as a subfamily while others, whose work takes the form of a review of a particular anatomical feature (structure of the thorax by Gurjeva, 1974; wing venation by Dolin, 1975), retain the classification first proposed by Hyslop (1917) in which the group is regarded as a tribe (Melanotini) of the subfamily Elaterinae. In view of the confused state of the major classification of the Elateridae no rank is assigned to the group in this work. Where necessary the term the '*Melanotus* group' or some similar expression is employed.

There is also some disagreement concerning the number of genera included in the *Melanotus* group. The Schenkling (1927) catalogue lists 8 valid genera with 4 nominal genera listed as synonyms. Schenkling's 8 genera include *Spheniscosomus* which du Buysson (1894: 129) had effectively reduced to a subgenus of *Melanotus* by treating it as 'group 1' of that genus. Fleutiaux (1933: 215) also employed *Spheniscosomus* as a subgenus of *Melanotus* as does Dolin (1979: 71) who remarks that the group includes 7 genera; he seems to have overlooked the fact that in the same work Fleutiaux (*loc. cit.* footnote) had reduced *Cremnostethus* to a subgenus of *Melanotus*. Stibick (1979(v): 179) refers to 8 genera but does not list the names. All the above-mentioned writers were obviously unaware of Champion's (1896: 446) work

in which he transferred *Dodecactenus* Candèze from the Elaterini (sensu Candèze, 1891(v): 103) to the group (sic) Melanotini or Fleutiaux' (1926: 110) corrections to the Schenkling (1925) catalogue in which the genus is transferred to the Melanotinae. As Fleutiaux does not refer to Champion it must be assumed that he was also unaware that the transfer had already taken place. It is also evident that neither Dolin nor Stibick knew of Binaghi's (1939(xii): 180) paper in which *Jonthadocerus* is transferred to the Athoinae, or that of Cobos (1958: 54) in which the type species *theryi* du Buysson, 1918 is synonymized with *rufescens* Escalera, 1914 (from *Athous*) and the author remarks that he agrees with du Buysson's supra-generic reassignment (see p. 89). Since the publication of the Schenkling (1927) catalogue the *Melanotus* group has been enlarged by the addition of 3 new genera and 4 new subgenera.

In the course of this work the type species, and in many cases the type material of the type species, of 19 of the 20 genus-group taxa now included in the group have been examined. *Natomelus* Dolin is the sole genus known to me only from the description.

A REVIEW AND PRELIMINARY EVALUATION OF THE CHARACTERS AND CHARACTER STATES USED TO DEFINE AND DESCRIBE TAXA OF ALL RANKS WITHIN THE *MELANOTUS* GROUP

In this section the classic characters and character states which have been used for over 100 years, and also previously neglected and newly discovered characters and character states which I believe may be of some value in the classification of the *Melanotus* group, are described and, in so far as it is possible to do so at the present, evaluated. In my opinion too little is known of the group to postulate any theories concerning plesiomorphic and apomorphic character states. The sequence of character states used in the data file (pp. 92) is dictated by personal preference and an attempt, admittedly not always achieved, to be consistent (Watson, 1984:90) and must not be interpreted as indicating a transformation series. For the sake of convenience the characters are discussed in the following order: the head and its appendages, prothorax, mesothorax and metathorax, wings and elytra, abdomen, legs and male and female genitalia.

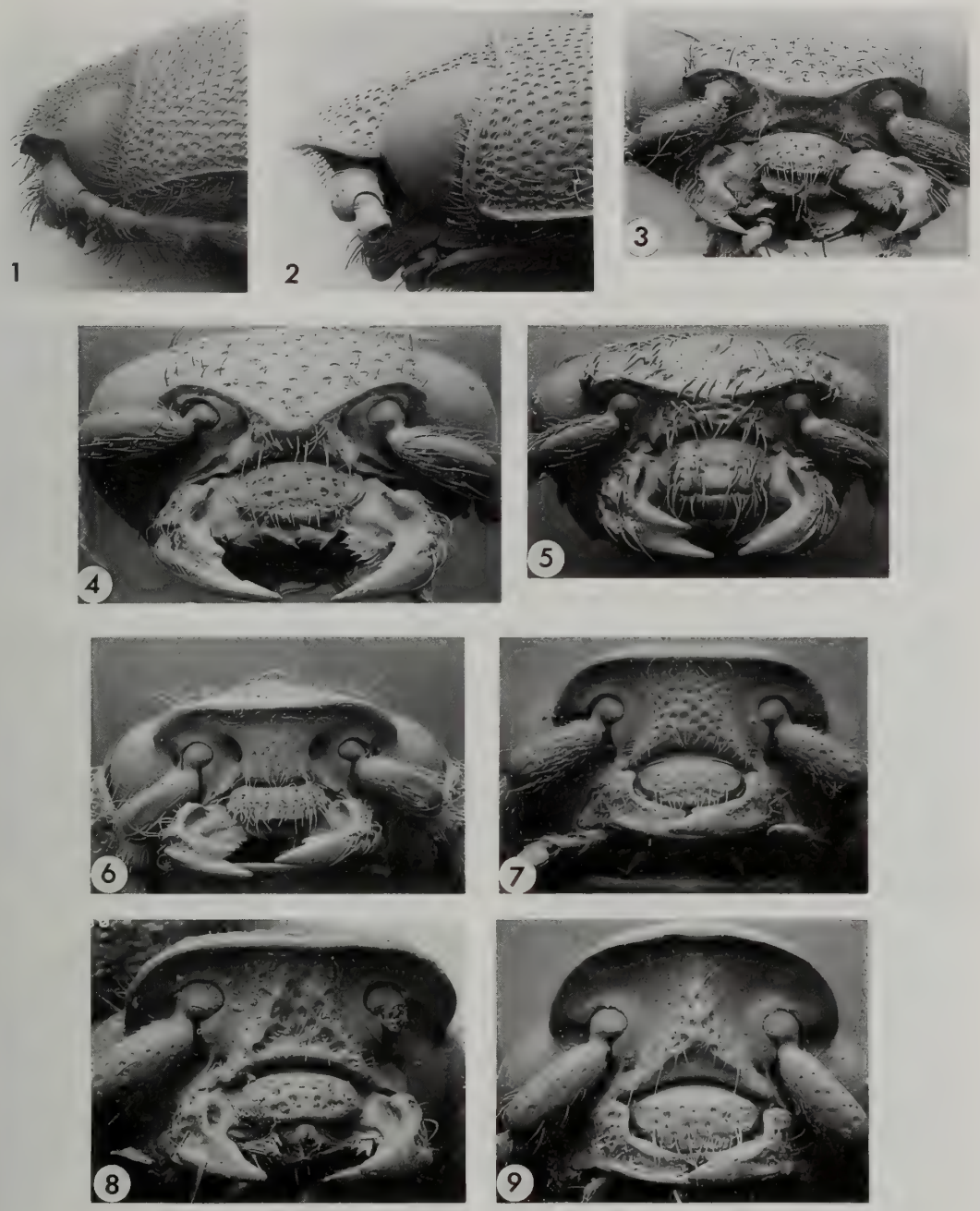
The names used to describe the anatomical features are those generally employed by elaterid workers. Where the terms or usage differ, a definition is given. It must not be assumed that the structures to which the names are applied are homologous with structures bearing the same name in other coleopterous families.

DERM. Throughout the group the greater part of the derm is punctured. The diameter, depth, density and distribution of the punctures vary from one part of the body to another and although there seems to be a certain amount of intraspecific variation the character appears to be of some value at the specific level. Unfortunately there is at present no generally accepted format for describing this feature.

HEAD. The two classic characters are the structure and appearance of the anterior portion of the head and the antennae. As far as I am aware there are no studies of the eyes such as those undertaken by Becker (1974) in his work on *Athous* and, apart from Quate & Thompson's (1967: 3) remarks concerning the mandibles, I do not know of any work on the mouthparts.

For the purpose of this discussion the anterior and dorsal regions of the head are divided into three sections to which the names vertex, frons and nasale are applied. The names are used because they are convenient and their use does not imply that the author believes that the areas are necessarily homologous with those of the same name more precisely defined in other groups.

The vertex extends anteriad from the dorsal margin of the occipital foramen to the line joining the point on each eye at which the supra-antennal carina arises. When the head is in its normal position the visible portion of the vertex is bounded laterally by the eyes. The vertex is rarely mentioned in descriptions although some authors refer to the colour and/or puncturation of the dorsal surface of the head. The frons extends anteriad from the anterior margin of the vertex; its anterior limit is marked by a carina, often called the frontal carina, formed by the junction in the mid line of the supra-antennal carinae. The frons is mentioned in almost every description and is generally described as 'projecting', 'sloping' or 'depressed' often qualified by expressions such as 'strongly', 'slightly' or 'feebly'. The condition of the surface is rarely described but occasionally an author may remark that it is flat or convex or that one or more depressions of unspecified size and shape are present. Examination of a large number of species has shown that, while the appearance of the frons appears to be constant intraspecifically, it is not possible to describe the degree to which it projects



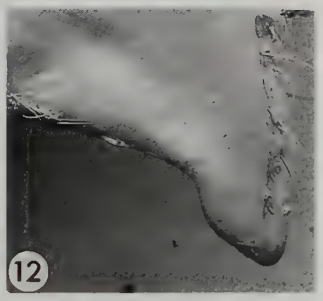
Figs 1–9 1–2, lateral aspect of head of (1) *Melanotus villosus*, (2) *Priopus niger*. 3–9, anterior aspect of head of (3) *Melanotus villosus*, (4) *M. guatemalensis*, (5) *M. staudingeri*, (6) *M. albertisi*, (7) *Priopus peregrinus*, (8) *P. homostictus*, (9) *P.prominens*.

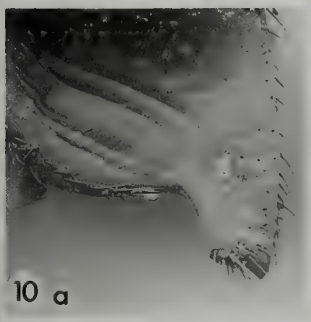
or slopes anteriad in terms of mutually exclusive character states as these merge imperceptibly into one another. However, as, up to the present, no intermediate state between 'frons depressed in the mid line' and 'frons not depressed in the mid line' as defined in #3 (p. 93) of the character descriptions has come to my notice the character has been included in the data file; it should be treated with circumspection. I do not believe the character is of any value above the rank of species.

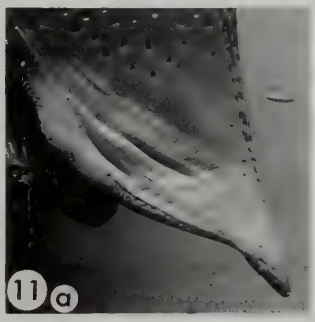
The term nasale as used by Quate & Thompson (1967) and Smith & Enns (1978) is applied to the area between the basal articulations of the antennae and extending vertically from the anterior margin of the head capsule (which for the purposes of this work corresponds to the line of articulation of the labrum) to the anterior margin of the frons. This area, for which the terms clypeus, epistome or fronto-clypeal region have also been used, is not homologous with the area of the larval head bearing the same name. The shape of the nasale depends upon the degree of projection and inclination of the frons; where the frons projects strongly the nasale is high and where the frons is depressed it is narrow and in extreme cases, where the frons slopes so steeply that the anterior margin is in close proximity to the anterior margin of the head, the nasale is reduced to the areas surrounding the articulation of each antenna and the narrow strip joining them (e.g. 004 *M. guatemalensis*, Fig. 4). Within the group the profile of the nasale ranges from straight to concave. When viewed from the front it may be flat or curved following the outline of the anterior margin of the frons. The appearance of the surface varies from one species to another (#30). In some the nasale is without distinctive features but in others there is a raised area in the mid line which may have carinate margins and/or a central depression (Figs 7 & 8). A few species have two short convergent carinae which unite to form an inverted 'Y' (Fig. 9). Unlike the well-defined polished vertical carina which joins the mid-point of anterior margin of the frons to the anterior margin of the head in many *Glyphonyx* species (e.g. *bimarginatus* Schaeffer, Fig. 62) the carina or carinae present on the nasale of *Melanotus* group species are never so well defined nor are they confluent with the anterior margin of the frons. Intraspecifically the appearance of the frons and nasale seem to be constant but within the group the states of each character merge into one another and appear in so many different combinations with different states of other characters that, as at present defined, these characters cannot be used in the construction of a key. Some *Melanotus* species (e.g. *albertisi*, 011 *depressus*, 039 *lewisi*, 040 *umbilicatus* and 029 *Szombatya formosana*) possess a pair of parantennal pits on the nasale (#4,1, p. 93; Fig. 6). The position of these pits, which lie on either side of the mid line, varies from one species to another. In some they are close together and in others they are more widely separated and lie closer to the basal articulation of the antennae than to each other. They may be round, crescent-shaped or with an irregular margin and either shallow or deep (#12). Quate & Thompson (1967: 32) describe those of some species as 'obsolescent'. The significance or function of the pits which, up till now have been observed only in *Szombatya* and certain *Melanotus* species, is unknown. As preliminary investigations have shown that the degree of development of the pits may vary intraspecifically, and that they appear in a very wide range of combinations with different states of other characters, I do not believe they are of any significance above the rank of species.

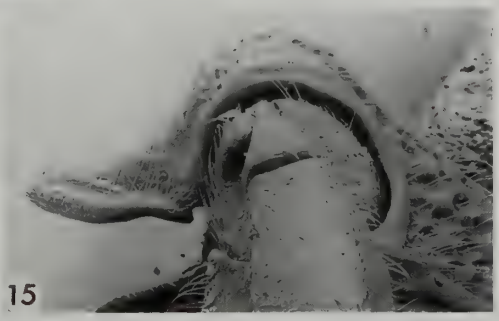
Certain Nearctic species (Quate & Thompson, 1967: 4) possess a mandibular pit, a clearly marked depression of varying size, near the base, on the lateral exposed margin of the mandible (#5). Although Quate & Thompson use this character as one of the main diagnostic features of a large group of Holarctic *Melanotus* species they remark (*op. cit.*: 2) that they do not believe it indicates a natural unit. The function of the pit is unknown. Up till now the feature has been observed only in New World species.

The length of the antennae and the relative size and shape of the second and third and third and fourth segments are often mentioned in the descriptions of species. Experience has shown that in many species, though by no means in all, the antennae of the males are longer and bear longer or longer and denser setae than those of the females, but differences in length have also been observed in individuals of the same sex from the same population. The relative shape and length of the second and third and third and fourth antennal segments (#1, p. 91) may be of some importance at the specific level but this feature is known to be very variable within the Elateridae and in my opinion the characteristic should not be given too much weight at either specific or generic rank. In the *Melanotus* group of genera the first, second and third antennal segments have a shiny appearance. This is due to the fact that the surface is smooth and almost entirely without punctures and to the absence of the dense short setae which cover the surface of the projecting portion of the remaining segments, giving them a matt appearance. I suspect that the appearance of the second and third antennal segments (glabrous/shiny or pubescent/matt), a character widely used









Figs 10–17 10–12, dorsal and ventral aspect of the posterior angles of the pronotum of (10, 10a) *Melanotus villosus* (arrow indicates posterior lateral incision of pronotum), (11, 11a) *Priopus peregrinus*, (12) *P. niger*. 13–17, mucro and anterior coxal cavity of (13) *M. villosus*, pecked line indicates profile of prosternum, (14) *M. guatemalensis*, (15) *M. nigricollis*, (16)*P. peregrinus*, (17) *P. ornatus*.

in the taxonomy of other families (e.g. defining carabid tribes and staphylinid genera) may prove to be of more value in the classification of the family than the relative size of the segments. The presence or absence of a median longitudinal carina on one or both flat faces of the fourth and some or all the following antennal segments can be a useful character to distinguish otherwise very similar species (#2, p. 93). The degree to which the carina is developed differs from one species to another. It may be strongly raised in the form of a sharp narrow ridge, less strongly raised with a rounded edge or barely perceptible, its position marked by a narrow glabrous area on the segment. Up to the present the antennal carina has been observed only in certain *Priopus* species (all previously assigned to *Neodiploconus*) and all *Neofleutiauxia* and *Anchiszombatya* species.

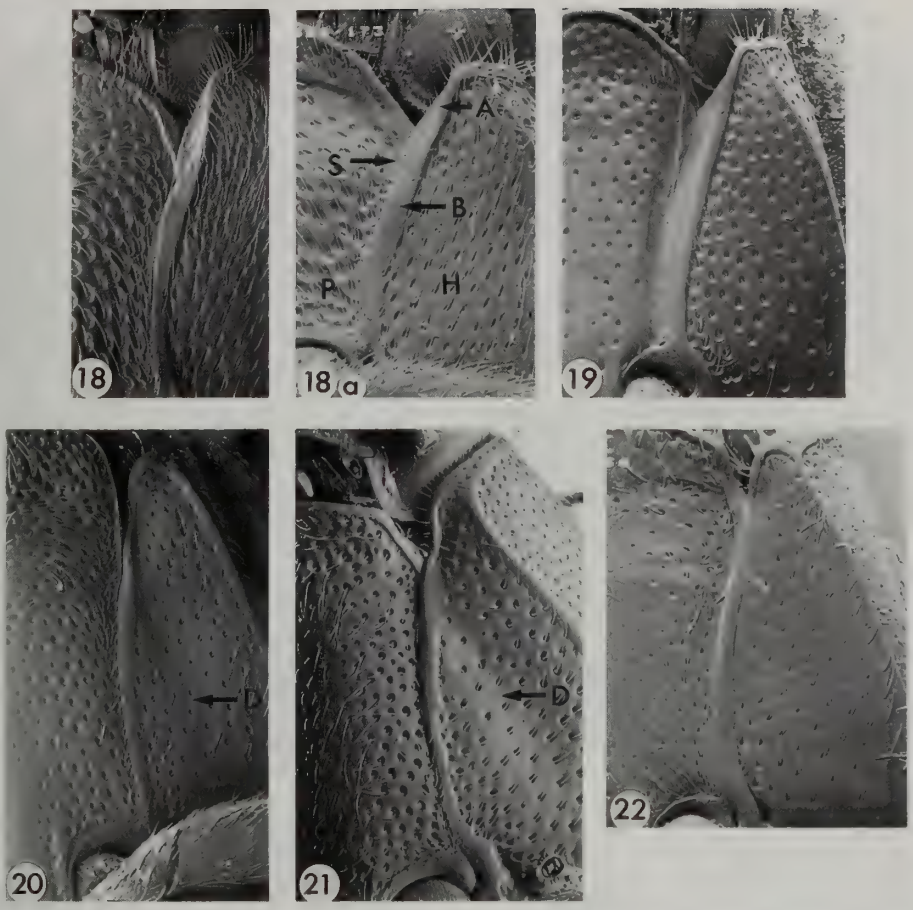
PROTHORAX. The chief classic character is the shape of the prothorax, especially whether it appears to be broader than long (transverse) or longer than broad (elongate). As most descriptions are subjective, based on observation and not measurements, and as in many species the prothorax of the male is very different in shape to that of the female, the character can be of little value until some means are found of defining the states accurately.

The second classic character is the presence or absence of lateral carinae, separating the pronotum from the hypomeron (#6, p. 96). Examination of the available material has shown that not only do some species possess incomplete carinae which do not attain the anterior angles but that others display an intermediate state in which the carina is so indistinct that it can be seen only under high magnification. It seems probable that in this group this feature has little or no significance above the rank of species.

Candèze (1860: 289) regarded the presence or absence of the lateral incisions on the posterior margin of the prothorax (#7, p. 93; Figs 10, 11) as one of the three diagnostic characters separating *Melanotus* and *Diploconus* (= *Priopus* of this work). Fleutiaux (1933) also made use of the character but curiously many workers do not refer to it in their diagnoses or descriptions. From the point of view of the key-maker the character is extremely useful in that it occurs in two distinct states, either present or absent, and, taken in conjunction with other characters, appears to separate discrete groups. The length of the sulcus arising from each basal lateral incision has been found to vary from one species to another and further studies may show it to be a useful character at the rank of species. The function of the basal lateral incisions and sulci is unknown. The two other characters used by Candèze to separate *Melanotus* and *Diploconus* are the appearance of the anterior portion of the pronotosternal suture (#28 & 29, p. 95; Figs 18–22) and the outline of the posterior free margin of the posterior coxal plate (#17, p. 94; Figs 32–37).

Some workers have considered the number of carinae on the posterior angles of the pronotum (#8, p. 94; Fig. 11) to be of some importance and in the majority of species there is no difficulty in deciding whether the angles are uni- or bicarinate. However, some species which possess a single well-defined carina on each hind angle display an indistinct, but unmistakable, trace of a second carina either mesad or laterad of the main carina; sometimes the additional carina is visible only on one side of an individual. I believe that though the character is undoubtedly of some value at the specific level, too much reliance should not be placed upon it.

The appearance of the pronotosternal (sometimes called the prosternal, sternopleural or prosternopleural) suture, a feature which often appears in keys to Elaterid genera, is mentioned in some descriptions of species belonging to the *Melanotus* group of genera. It is variously described as single or double and the anterior portion either closed or open, grooved or channelled for a greater or lesser part of its length. The terms 'double' or 'single' are misleading in that in the Elateridae, with rare exceptions (e.g. *Arhaphes* and allied genera in which the sutures have been described as absent or invisible, but even in these genera careful examination under high magnification will reveal traces of a suture), the suture or line of junction between the prosternum and hypomeron is invariably manifest as a single fine line. Examination of a large number of specimens has shown that in those species in which the suture is described as double it is accompanied for at least the anterior half of its length, and in the majority of species throughout its entire length, by a narrow polished band of cuticle (Figs 18, 18a, 19, 22). This band is the modified inner margin of the hypomeron. It is almost always entirely impunctate; if punctures are present they are much smaller and shallower than those present elsewhere on the hypomeron. The impunctate band, which may be slightly raised, is almost always separated from the punctate area by a distinct groove in at least the anterior half of its length. This groove is often punctured at the base. The length of the band is variable. In *Melanotus* species (Figs 18, 18a) it extends anteriad beyond the point at which the adjacent margins of the prosternum and the hypomeron diverge and



Figs 18–22 Ventral aspect of left hand side of prothorax of (18)*Melanotus brunnipes*, (18a) *M. villosus*, A–anterior free border of hypomeron, B–border of hypomeron, H–hypomeron, P–pronotosternum, S–pronotosternal suture, (19) *Metriaulacus nigrolaterus*, (20) *Priopus peregrinus*, (21) *P.niger*, D–diagonal depression on the hypomeron. (22) *Anchiszombatya porrectifrons*.

accompanies the inner free margin of the hypomeron to the anterior angle of the prothorax; the anterior portion is almost always inclined mesodorsad and is often concave. In *Anchiszombatya* (p. 86; Fig. 22) the band either ends at the point where the margins diverge, or if it continues anteriad it becomes narrower and lies in the same plane as the adjacent portion of the hypomeron. In species in which the pronotosternal suture is described as single it is not accompanied by the well-defined polished band described above although a narrow band may be visible on the anterior free margin of the hypomeron (Figs 20 & 21). In these species the greater part of the margin of the hypomeron adjacent to the suture is punctate although the punctures may be smaller and sparser than elsewhere on the hypomeron. Care must be taken not to be misled into interpreting an impunctate area near the suture and/or the presence of a short row of confluent punctures more or less parallel with the suture as the hypomeral border described above. In this work these two character states are described as follows (#10, p. 96) 'inner margin of hypomeron with a well-defined narrow, completely or almost completely impunctate border . . .' or 'inner margin of the hypomeron without a narrow impunctate border . . .'. In a recent paper on *Crepidomenus* and its allies, Calder (1986: 11) described the pronotosternal sutures as marginate along the hypomeral border. This margin is similar to that present in *Melanotus* in that it is separated from the rest of the hypomeron by a distinct groove and, in most species, slightly raised above the rest of the hypomeron. *Crepidomenus* differs from *Melanotus* in that the margin is less distinct because it is fairly densely punctured with setae arising from the punctures.

In the course of the examination of the sutural area it became increasingly clear that in the

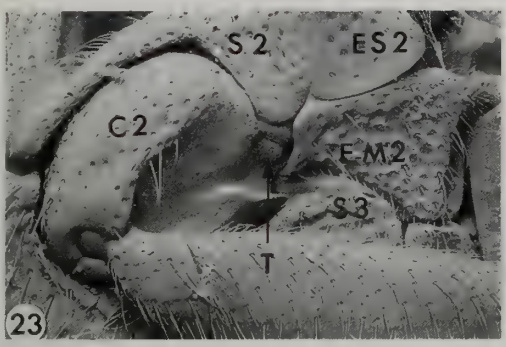
species in which the anterior part of the pronotosternal suture is described as 'open', 'channelled' or 'depressed' the inner margin of the hypomeron is invariably bordered and the anterior portion of the border is angled meso-dorsad to a greater or lesser degree. This feature may be apparent only at the anterior free margin of the hypomeron (where the border may also be concave) or, as in the majority of species, discernible within the anterior third of the length of the suture although a few species (e.g. 014 *M. hapatesus* Candèze) are known in which the border is distinctly declivous for about the anterior two-thirds of the length of the suture. The degree to which the lateral margins of the prosternum slope laterad-dorsad is dependent on the angle of the border of the hypomeron. The character (#27, p. 97) is seen in its most strongly developed state in *Metriaulacus* (017, Fig. 19) in which the entire length of the inner portion of the impunctate border of the hypomeron is not only so strongly angled meso-dorsad that it is almost vertical but it is also concave. The adjacent portion of the lateral margin of the prosternum is steeply declivous and generally almost entirely impunctate (Fig. 19). It is sometimes separated from the median portion of the prosternum by a distinct longitudinal carina. The suture lies at the base of the groove which serves to accommodate the basal and a variable number of additional antennal segments. Up to the present I have not seen any species in which the inner margin of the hypomeron lacks a border in which the adjacent portions of the hypomeron and prosternum are distinctly declivous towards the pronotosternal suture.

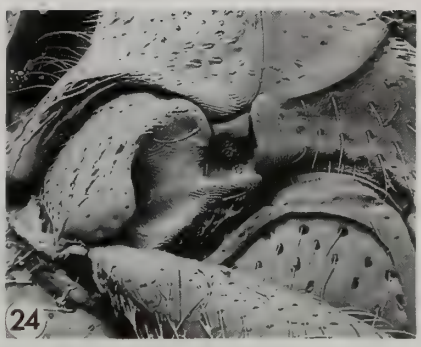
A feature which appears to have remained unnoticed is that in some species, in which the inner margin of the hypomeron is not bordered, the hypomeron bears a feeble, sometimes almost imperceptible, depression which arises at or near the point of divergence of the prosternum and hypomeron and runs diagonally across the hypomeron towards the posterior angle (D in Figs 20,21); this depression appears to serve the same purpose as that accompanying the pronotosternal suture, that is to accommodate a number of antennal segments. A similar depression is present on the hypomeron of some species belonging to the *Megapenthes-Melanoxanthus* complex.

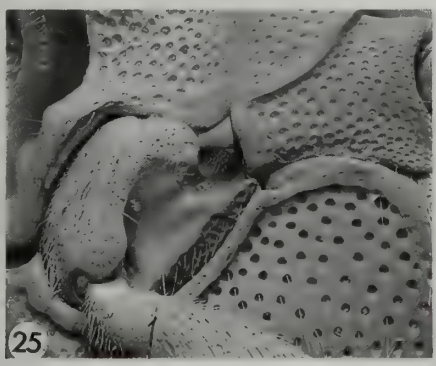
The appearance of the posterior angles of the pronotum in ventral aspect (#26, p. 97) is a character which does not appear to have been taken into consideration in any previous work on the *Melanotus* group. The angles appear in one of two states; they either terminate in a point or they are truncate (Figs 10a, 11a). The point may be sharp or rounded and the truncation straight or with a feeble arcuate or angled emargination. In one species known to me (*P. niger* Van Zwaluwenburg, Fig. 12) the ventral aspect of the posterior angle of the pronotum is wedge-shaped, but there is no doubt that the apex terminates in a point. Up to the present now no intermediate state has come to my notice.

The profile of the posterior prosternal process or mucro (#14, p. 94; Figs 13–17), especially whether the ventral face is horizontal, slopes dorsad or is angled, has been used as the chief, and in some cases the only, diagnostic character of several genus-group taxa (020 *Cremnostethus*, p. 59; 032 *Kensakulus*, p. 59; 006 *Melanotopsis*, p. 59 and 028 *Spheniscosomus*, p. 59) in the *Melanotus* group. Fleutiaux (1933: 214), who seems to have been aware that it is not possible to present discrete, unambiguous, character states for this character, reduced *Cremnostethus* and *Spheniscosomus* to subgeneric status but his action has not been generally accepted. Very few descriptions include any reference to the appearance of the dorsal face or apex of the mucro, probably because both are difficult, if not impossible, to examine without disengaging the prothorax from the rest of the body. The dorsal face may be parallel to the ventral surface or slope towards the apex. The apex may be bulbous, rounded, pointed, emarginate or stepped or present a combination of two or more of these states. Further studies are required in order to discover whether there is a constant relationship between the profile of the mucro and the structure of the mesosternal groove. It seems possible that the appearance of the mucro, and also of the associated mesosternal groove, may prove to be an extremely useful character to distinguish one species from another and, in my opinion, these features should always be mentioned in descriptions.

MESOTHORAX AND METATHORAX. In the majority of species the scutellum is steeply declivous to the prescutum, with a distinct angle between the visible horizontal or sloping portion and the prescutum which is hidden by the posterior portion of the prothorax in living beetles at rest and in the majority of museum specimens. However, in one African species (040 *M.umbilicatus*) the scutellum slopes gradually to the prescutum; in this case the prescutum, which is matt, is separated from the slightly more shiny scutellum by a transverse ridge. In general the scutellum is elongate but the ratio of length to width varies from one species to another. The outline is variable: the anterior margin many be arcuate, straight or emarginate and with or without a median notch or incision (#9, p. 94). The lateral margins may be







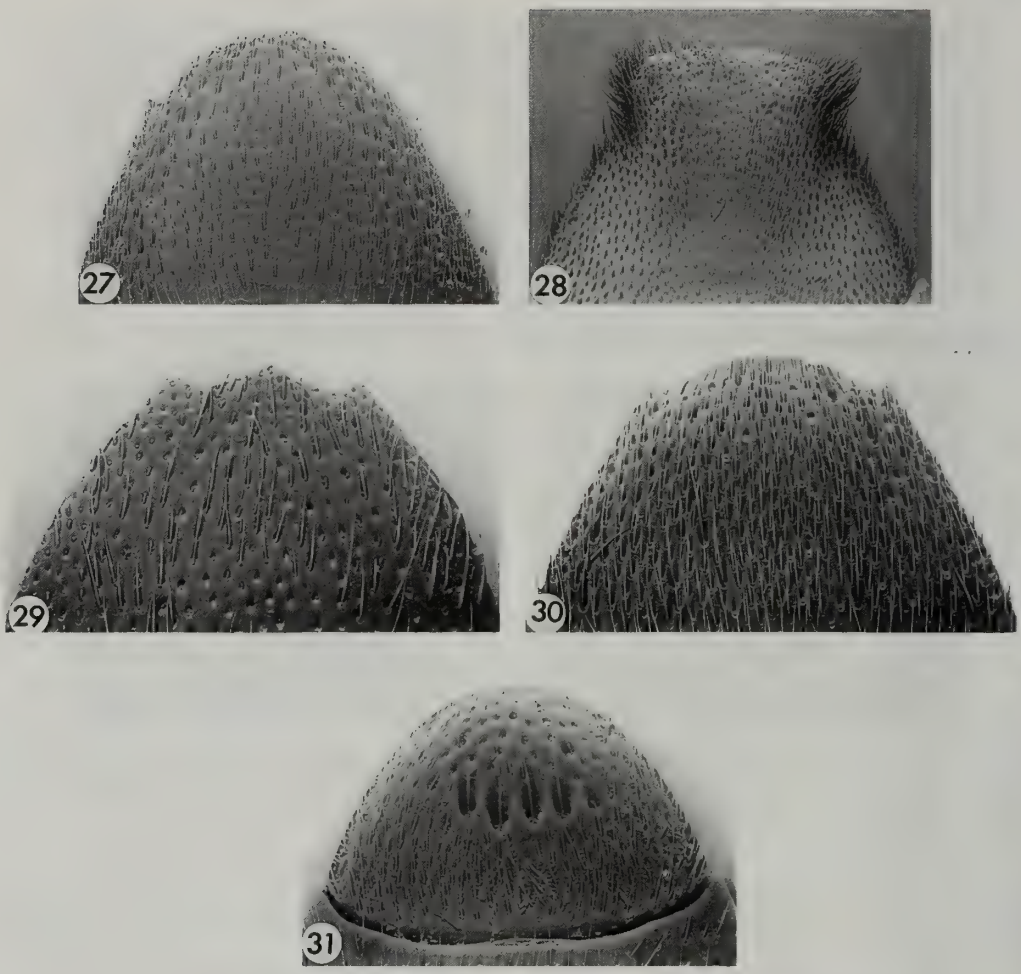
Figs 23–26 Mesocoxa and mesocoxal cavity and part of mesosternal groove of (23) *Melanotus villosus*, C2–mesocoxa, EM2–mesepimeron, ES2–mesepisternum, S2, S3– mesosternum & metasternum, (24) *Anchiszombatya porrectifrons*, (25) *Priopus peregrinus*, (26) *P. homostictus*.

straight or emarginate and parallel or divergent posteriad; the posterior margin is usually arcuate although in some species it is straight and in a few it is emarginate or notched. The dorsal surface may lie in the same plane as the elytra or be more strongly inclined; it may be flat or slightly convex, strongly or feebly grooved or impressed longitudinally. Preliminary studies have shown that the states of these characters merge into one another to such a degree and appear in so many combinations with each other that, as at present defined, they are of little use as key characters. Nevertheless I believe that the appearance of the scutellum may well prove to be of some value as a diagnostic character at specific rank.

The profile of the margin of the mesosternal groove (Figs 14, 23–26) has occasionally been mentioned in descriptions and examination of the available material has shown that it may be almost horizontal, slope anteriad, or be either distinctly or feebly angled and that, though the states merge into one another, there is little or no intraspecific variation. Unfortunately I have so far been unable to define the character states satisfactorily (but see #15, p. 94). I believe that the outline of the aperture of the mesosternal groove, which varies in shape from 'U' to 'V' but which is rarely mentioned in descriptions, may also be of some value in distinguishing one species from another. Up to the present my investigations have failed to show any constant relationship between the shape of the mucro (p. 46) and the mesosternal groove.

The mesosternum and metasternum abut between the middle coxal cavities, the suture appearing as a transverse line immediately posterior to the posterior margin of the mesosternal groove. In some species the posterior margin of the mesosternum (which at this point forms the border of the mesosternal groove) is slightly raised above the metasternum and in others the two sclerites lie in the same plane. In the latter case the suture may appear as a fine line in the cuticle or it may lie at the base of a groove. In two species (see *Dodecactenus*, p. 58, erected for a species believed to lack the suture) the suture cannot be seen except under high magnification when it becomes visible as a fine, but distinct, hairline in the highly polished cuticle (#16, p. 94).

The structure of the margin of the mesocoxal cavity has recently been used as one of the diagnostic character states of the *Melanotus* group of genera (#13, p. 94). In his diagnosis of the



Figs 27–31 Last visible abdominal sternite of (27) *Melanotus villosus*, (28) *M. brunnipes y*, (29) *M. cuneolus*, (30) *Priopus ciprinus*: note larger punctures with longer setae, (31) *Szombatya* sp. y.

subfamily Melanotinae Stibick (1979(v): 179) states 'mesocoxae open (sic) to mesepimeron but closed to mesepisternum' (i.e. the mesepisternum does not form part of the margin of the mesocoxal cavity, see #13,1, p. 94) and this description applies to the majority of specimens examined although the length of the suture between the mesepimeron and mesosternum is variable. In *Anchiszombatya* and *Melanotus* species it is relatively long (Figs 23, 24) whereas in the majority of *Priopus* species the length of the suture between the two sternites is much shorter (Fig. 25) and in one species known to me (022 *Priopus homosticus*, Fig. 26) the mesepisternum quite clearly separates the two sclerites and forms part of the margin of the mesocoxal cavity. Further studies are required to evaluate the importance of the structure of the margin of the mesocoxal cavity in the *Melanotus* group of genera.

WINGS. The wing of *Melanotus avitus* Candèze figured by Dolin (1975: fig. 1 no. 5) resembles that of *M. mouldsi* (015), figured by Calder (1983: 259, fig. 4). As far as I am aware there are no descriptions or figures of the wings of other species. Until now I have not found any species in which the wings are reduced or absent.

ELYTRA. The general shape of the elytra does not vary greatly within the *Melanotus* group; in some species they narrow more strongly from the base to the apex than in others but this difference may exist between the sexes of one species. Within the group the apices of the elytra may be separately or conjointly rounded, or the apex of each elytron

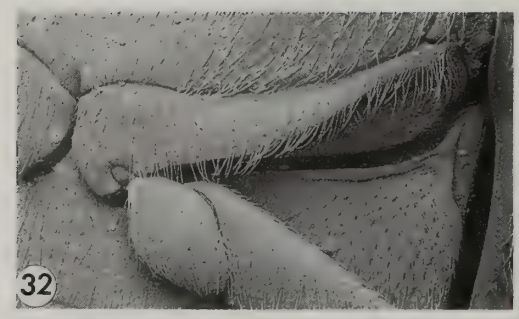
may be strongly or feebly truncate or emarginate or the sutural margin drawn out into a sharp or rounded projection (#11, p. 96). The margin of the apex of the elytra is smooth in the majority of species but in a few (e.g. 004 *M. guatemalensis*) it is feebly crenate. The outline of the apex of the elytra has been used to distinguish subgenera (e.g. Fleutiaux (1933); 005 *Neodiploconus* s.str. and 023 *N.* (*Ploconides*) and 028 *Melanotus* (*Sphenis-cosomus*) and 031 *M.* (*Tenalomus*)) but examination of the available material has shown that the various states merge imperceptibly into one another. Van Zwaluwenburg (1940: 128) unintentionally drew attention to the problem when he remarked that the elytra of the new *Neodiploconus* (now *Priopus*) species (*rubriventris*) he was describing had a 'vaguely truncate apex'. The surface of each elytron bears 9 punctate or punctate and grooved longitudinal striae which may be more strongly impressed in the basal portion. In a few species the striae, though distinct at the base, become progressively less well-defined towards the apex. In a small number of species the outer striae are less well-defined than those nearer the suture and in some individuals (?different species) they are completely missing. The interstriae are punctate, the punctures arranged in more or less regular longitudinal rows or scattered irregularly. Further studies are required to establish whether these features are of any value above specific rank.

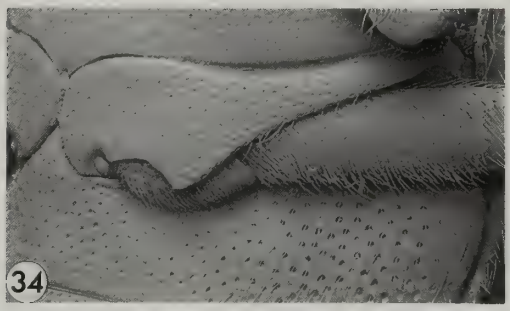
ABDOMEN. Until now the morphology of the abdomen has attracted little attention. In some descriptions the colour of the sternites, which may differ from that of the rest of the body, is mentioned and occasionally reference is made to the puncturation and pubescence. In almost all the species examined the 5th visible abdominal sternite narrows to a bluntly arcuate apex (as Fig. 27). Preliminary studies have shown that the length : width ratio of the last visible sternite may differ from one individual to another and that there may be a distinct difference between the sexes of the same species, but up till now no work has been carried out to discover whether the ratio is constant within each species or to define the differences in a satisfactory manner. A few species are immediately recognisable by the appearance of the margin or surface of the last visible abdominal sternite. Kiesenwetter (1858: 250) described the distinctive truncate outline of the apex of the 5th visible sternite of the Palaearctic *M. brunnipes* (042, Fig. 28) and more recently Platia (1986: 2) described the pits on the 5th visible sternite of *Szombatya* (Fig. 31) species. In one species of *Melanotus* (010 *cuneolus*, Fig. 29) the apex of the 5th visible sternite is emarginate on either side of the midline and in one species of *Priopus* (021 *ciprinus*, Fig. 30) the margin on either side of the apex is drawn out into a small projection. The fact that these features (#20, 21, p. 94) were not noticed by the original describers or subsequent workers suggests that the abdomen is only rarely examined and that modifications of the margin and surface of the fifth visible sternite may occur in other species.

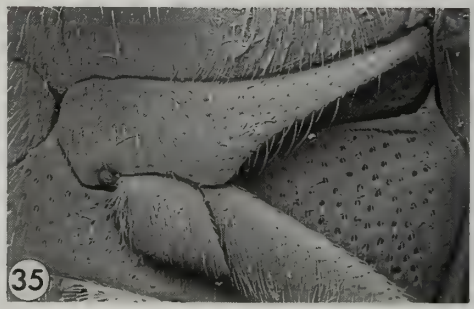
Examination of the available material has shown that in the majority of *Melanotus* and *Priopus* species the abdominal tergites (#22, p. 94) are thin and pale in colour so that the contents are partially visible through them. In a few species in each genus (e.g. 008 *Melanotus albernus*, 006 *M. cete*, 009 *M. cladestinus*, 036 *M. restrictus* and 038 *Priopus boninensis*, 041 *P. nigerrimus*, and 027 *P. ornatus*) the tergites are strongly sclerotized and dark in colour. Similar differences in the appearance of the tergites of otherwise very similar species are known to occur in the *Cardiophorus* group of genera. This feature may be adaptive (it is known to occur in many strongly flying Coleoptera) but as nothing is known of the biology of the species no conclusions can be drawn. The 7th abdominal tergite of four species of *Melanotus* is figured by Leseigneur (1972: 161, figs 153–156) and their appearance suggests that this structure may display character states which might be of use at specific rank.

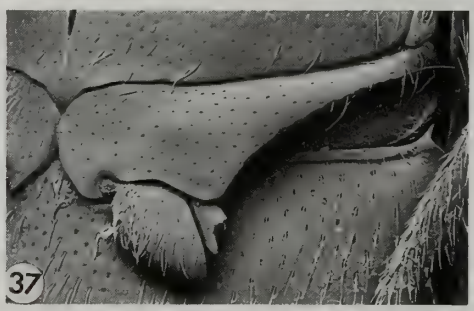
LEGS. Both Candèze (1860: 291 & 299) and Fleutiaux (1933: 206) comment that the posterior free margin of the posterior coxal plate of the genus-group taxon now known as *Priopus* is furnished with a tooth (#17, 1, p. 94; Figs 34, 35) whereas that of *Melanotus* is not (#17, 2, Fig. 32). Examination of the available material has shown that in some *Priopus* species (e.g. 027 *ornatus*, Fig. 36) the tooth is small while some *Melanotus* species (e.g. 035 *carinifer*, Fig. 33) possess a distinct tooth. In my opinion the difference between these genera lies not in the presence or absence of a tooth but in its position. Preliminary studies suggest that in *Priopus* (Figs 34–36) the distance between the inner margin of the posterior coxal plate and the tooth is equal to approximately one-third of the length of the coxal plate while in *Melanotus* (Figs 32, 33) the tooth or a slight protuberance lie at approximately the middle of the length of the plate. Further studies are required to confirm that the position of the tooth, if present, is constant within the genera as defined in this work.

Preliminary investigations suggest that there are interspecific differences in the length of the









Figs 32–41 Posterior coxal plates and legs. 32–37, posterior coxal plates of (32) *Melanotus villosus*, (33) *M. carinifer*, (34) *Priopus peregrinus*, (35) *P. homostictus*, (36) *P. ornatus*, (37) *Anchiszombatya porrectifrons*. 38–39, right front leg of (38) *Melanotus villosus*, (39) *M. legatus*. 40–41, tarsi of *Psellis promiscua*: (40) lateral aspect, (41) dorsal aspect.

middle femora compared to the length of the metasternum and of the posterior femora and tibiae compared to the length of the posterior coxal plate. In the majority of *Melanotus* group species the apex of the middle femur attains or very nearly attains the posterior margin of the metasternum, but in *Metriaulacus* species the apex of the femur clearly falls short of the posterior margin. Further work is needed to discover whether this character is of any value and whether and how the states can be defined. In some species the posterior femora and tibiae are the same length as, or only fractionally longer than, the posterior coxal plates with the result that when the legs are drawn up against the body the femoro-tibial articulations cannot be seen from above. In other species, in which the femora and tibiae are longer, the tip of the femoro-tibial articulation is visible and in a few species the mesofemora and tibiae are so long compared with the width of the body that not only the articulations but also a short portion of both leg segments are visible from above. Owing to the difficulties encountered in defining the states the characters have not been included in the DELTA-format data file.

The majority of species resemble *M. villosus* in that the tibiae are feebly compressed laterally and, viewed in profile, widen very slightly towards the apex (#18, 2, Fig. 38). Over 100 years ago Candèze (1873: 21) drew attention to the flattened falciform anterior tibiae of *Melanotus legatus* Candèze (#18, 1, Fig. 39) and Schwarz (1892(viii): 159) remarks that the anterior tibiae of *M. ferrugineus* Schwarz are strongly compressed and slightly curved. Lewis (1894: 192) mentions this feature in his description of *M. longipennis* (= 039 *lewisi* Schenkling) but apart from Kishii's (1964: 10) comments on *legatus* and *lewisi* no one seems to have considered it necessary to mention the appearance of the legs. Examination of the available material has shown that in a few species, including the recently described Australian *Melanotus mouldsi* Calder (015), not only the tibiae but also the anterior, and to a lesser extent the middle, femora may be compressed and consequently appear wider than those of most other species. In these species both segments may also be curved to a greater or lesser degree. Up to the present I have not been able to devise a means of defining the shape of the legs as discrete character states (but see #18). Schwarz (1892(viii): 159–160) seems to have come to the same conclusion as the character, first mentioned in couplet 23 of his key, is not mentioned again after the first half of couplet 24.

The structure of the third tarsal segment (#19) appears to be of some value at generic rank. In *Melanotus*, *Metriaulacus*, *Priopus* and *Anchiszombatya* this segment is horizontally or obliquely truncate distally (Figs 38, 39) and in *Szombatya* there is a very small ventral prolongation. In *Psellis* (Figs 40, 41) the third segment is distinctly dorsoventrally depressed, the ventral portion extending beneath the fourth segment but not attaining its apex, while in *Neofleutiauxia* the third segment is less strongly dorsoventrally depressed but extends beneath the entire length of the fourth segment and may even underlie part of the fifth (well illustrated by Platia, 1986: 7, fig. 2). Up to the present no intermediate states have been found. These investigations have shown that there are differences in the vestiture of the underside of the tarsi, a feature which may repay further study.

The claws, which are generally described as pectinate, bear 6 to 8 small teeth between the base and apex. My observations have shown that Candèze's (1860: 299) remark, that in *Melanotus* the number of teeth on the claws varies not only within the genus and between the legs of one individual, but that each one of a pair of claws may have a different number of teeth, is fully justified. The same appears to be true of the other six genera. Pectinate claws are held to be one of the commonest adaptations to an arboreal mode of life (Stork, 1987: 275) and certainly many Melanotines have been found on trees, bushes and herbaceous plants. Whether the pectinate claws confer advantages over the many elaterid species without pectinate claws which live in the same habitat is unknown.

MALE AND FEMALE GENITALIA. Quate & Thompson (1967: 5) are of the opinion that the genitalia of both sexes of *Melanotus* species are important taxonomically and my own experience leads me to believe that this is true at specific rank. Prelimary studies suggest that there are no constant differences in the genitalia of the genera as defined in this work but further studies are needed to confirm or disprove this belief.

Within the *Melanotus* group there is a considerable range of variation in the appearance of the aedeagus especially as regards the shape and relative size of the mid and lateral lobes (#23, 24, p. 95). In the majority of species the mid lobe is slightly longer than the lateral lobes but in a few species the mid lobe projects a long way beyond the lateral lobes, either because it is longer or because the lateral lobes are greatly reduced in length compared to those of otherwise very similar species. The mid lobe may be broad or narrow and pointed or rounded at the apex. The

lateral lobe may be rounded or pointed at the apex or may bear an apical barb or apical and basal barbs. The size of the barb varies from very short to so long that its base lies near the base of the lateral lobe and its outline may be well defined or so indistinct that the lateral lobe appears to lack a barb. Up till now I have not been able to discern any constant relationship between the length and shape of the median lobe and the length and shape of the lateral lobes. For figures showing the range of shape of the aedeagus within the *Melanotus* group see Schwarz (1892(viii): pl. 2), Van Zwaluwenburg (1948: 276, figs 5 & 6; 1959: pl. 2, figs 17–27) and Quate & Thompson (1967: 75–78, figs 4–7).

The female internal (the term is that commonly used in the Elaterid literature; it refers to the location, not the origin, of the structures) organs of reproduction of a number of American *Melanotus* species have been figured by Quate & Thompson (1967: 79–83, figs 8–12). Examination of specimens identified as *Neodiploconus peregrinus* Candèze (020) and *N. (Ploconides) spiloderus* Candèze (023), *Neofleutiauxia* sp., *Metriaulacus gobius* Candèze (018), *Psellis promiscua* Erichson (026), and *Szombatya* sp. has shown that the internal structures are very similar in general appearance to those of known *Melanotus* species. In all the females examined each valve of the ovipositor bears a stylus (= coxite, Becker, 1956: fig. 5d) the size of which appears to be subject to interspecific variation. There is also considerable interspecific variation in the size and degree of sclerotization of the valves. In the majority of species examined the valves have a delicate appearance as they are feebly sclerotized and pale in colour; in fresh or relaxed specimens both the struts and valves are very flexible. In some species (e.g. 006 *Melanotus cete*, 018 *Metriaulacus gobius*) the valves are slightly more strongly sclerotized, but pale in colour and fairly flexible. In a few *Priopus* species (e.g. 025 *prominens*, 030 *bioculatus*) the valves are more strongly sclerotized, darker in colour and much less flexible (#31, p. 95). Useful descriptions of the external female genitalia of Elaterids based on a study of *Ctenicera aeripennis* will be found in Zacharuk (1958) and of the internal female genitalia in Becker (1958).

THE LARVAE OF THE *MELANOTUS* GROUP

Whether the seven *Melanotus* group genera as defined in this work can also be recognised in the larval state is unknown. The larvae of a number of *Melanotus* species have been described (Dolin, 1978 (USSR); Hyslop, 1915 and Riley & Keaster, 1979 (USA); Ohira, 1962(viii) (Japan), and see also Gaedike, 1969, 1975, 1979) but until now the larvae of species attributed to the other six genera have remained unknown. Blunk & Muhlmann (1954: 46) remark that the larva of '*Melanotus (Neodiploconus) rubidus*' (sic) Erichson is a soil pest in Java but do not give a description of the larva or a reference to a description or the source of their information. In an earlier edition of the same work (Reh, 1912: 483) the species is attributed to *Melanotus*. Blunk & Muhlmann's reference to *Neodiploconus* is presumably based on Schwarz (1906: 184) who transferred the species to *Diploconus* without comment (see p. 84). Examination of the type and other material has shown that *rubidus* Erichson is a *Priopus* species but that Candèze misidentified the species (see p. 62). The identity of the Javanese pest remains in doubt.

As in the case of the adults it is very difficult to compare the descriptions of the larvae because the writers rarely refer to the same characters. One feature which is mentioned or figured by all workers is the shape of the 9th abdominal segment. In all the *Melanotus* species described the tergite is flattened in the caudal half; the apex is rounded or pointed with a lateral rounded or pointed projection on either side of it (well illustrated by Ohira, 1962: pls 43–48).

When the larvae of the other six genera are discovered it will be intersting to see whether their structure supports the relationships suggested on p. 53.

THE PROPOSED CLASSIFICATION OF THE *MELANOTUS* GROUP

This classification, which is based on certain anatomical features which were chosen because they are believed to display reasonably constant character states, is offered as a practical means of subdividing the *Melanotus* group into well-defined subgroups. The fact that, with one exception which is included in the key, all the taxa known to me (about half the valid species) and several hundred unidentified specimens (probably representing over 100 species, a small number of which may have been described) fall unequivocally into one of seven subgroups, here defined as genera, suggests that there is some justification for the acceptance of these genera, at least as an interim

measure until more is known of the group in particular and the Elateridae as a whole.

The classification makes no claim to reflect the relationships within the group. As my experience of the family leads me to suspect that the structure of the posterior margin of the pronotum (the presence or absence of lateral incisions) and the inner margin of the hypomeron are features of some importance, I believe that similarities in these structures suggest that *Melanotus*, *Metriaulacus* and *Psellis* are more closely related to one another than to *Priopus*, *Anchiszombatya*, *Neofleutiauxia* and *Szombatya*. On the basis of the structure of the margin of the hypomeron *Priopus* and *Neofleutiauxia* may be more closely related to each other than to *Anchiszombatya* and *Szombatya* but in my opinion a much greater knowledge of all aspects of the beetles and also of the origin and development of the features considered as of importance in classification of the group is necessary before conclusions of any value can be reached.

For taxa removed from the *Melanotus* group of genera, *species incertae sedis* and *species inquirendae* see pp. 89, 90.

Key to genera and one aberrant species.

This key is an edited version of the natural language format of the numerical key on p.00.

1 Pronotum without basal lateral incisions (Fig. 11) 2

– Pronotum with basal lateral incisions (Fig. 10) 6

2 Inner margin of the hypomeron with a well-defined narrow, completely, or almost completely, impunctate border separated from the rest of the hypomeron by a distinct groove in at least the anterior half of its length or raised above it (as Figs 18, 18a, 22) 3

– Inner margin of the hypomeron without a well-defined narrow impunctate border; if the portion of the hypomeron adjacent to the pronotosternal suture is impunctate the impunctate area is not separated from the rest of the hypomeron by a distinct groove or raised above it or sloping mesodorsad in the anterior third of its length (Figs 20, 21) 4

3 In ventral view the posterior angles of the prothorax terminate in a point (as Figs 11a, 43); ventral surface of the last visible abdominal sternite without large punctures or pits near the apex (as Fig. 27); the inner border of the hypomeron does not extend beyond anterior divergence point of the hypomeron and prosternum, or if it is prolonged anteriorly it becomes much narrower and lies in the same plane as the adjoining portion of the hypomeron (Fig. 22) ..... ***ANCHISZOMBATYA***

– In ventral view the posterior angles of the prothorax are truncate at the apex (as Fig. 10a); ventral surface of the last visible abdominal sternite with two or more large punctures or pits near the apex (Fig. 31); the inner border of the hypomeron extends beyond the anterior divergence point of the hypomeron and prosternum forming the anterior free border of the hypomeron which slopes mesodorsad and may be concave (as Figs 18, 18a) ..... ***SZOMBATYA***

4 In ventral view the posterior angles of the prothorax are truncate at the apex (as Fig. 10a) ..... ***Priopus boninensis***

– In ventral view the posterior angles of the prothorax terminate in a point (Fig. 11a) 5

5 Third tarsal segment dorso-ventrally depressed, with the ventral prolongation extending beneath the entire length of the 4th segment ..... ***NEOFLEUTIAUXIA***

– Third tarsal segment simple vertically or obliquely truncate distally (as Figs 38, 39); if a small ventral prolongation or lobe is present it does not extend beneath the entire length of the 4th segment ..... ***PRIOPUS***

6 Pronotosternal suture situated at or near the base of an impunctate groove which attains or almost attains the anterior margin of the anterior coxal cavity; the sides of the groove are formed by the steeply declivous, and often concave, inner border of the hypomeron and the impunctate lateral margin of the prosternum (Fig. 19) .... ***METRIAULACUS***

– Pronotosternal suture not situated at the base of a groove; if the inner border of the hypomeron and the lateral margin of the prosternum are steeply inclined towards one another the groove or channel so formed does not extend beyond the anterior two-thirds of the length of the suture and the inner wall of the groove, formed by the prosternum, is punctured (Figs 18, 18a) 7

7 Third tarsal segment dorso-ventrally depressed, the ventral prolongation does not extend beneath the entire length of 4th segment (Figs 40, 41) ..... ***PSELLIS***

– Third tarsal segment simple, vertically or obliquely truncate distally, if a small ventral prolongation or lobe is present it does not extend beneath the entire length of the 4th segment (Figs 38, 39) ..... ***MELANOTUS***

CONVENTIONS, TERMS, SYMBOLS AND ABBREVIATIONS USED IN THE LISTS OF SPECIES EXAMINED

Conventions

1. All the material examined is in the BMNH unless specifically stated to be elsewhere.

2. Where only the name and author of a species is listed, interpretation of the species is based on material believed to be correctly identified.

3. Records of specimens examined follow the specific name after a comma; other information, e.g. concerning lectotype designations, follows a full stop.

4. Information concerning the data labels on specimens is recorded only where the author believes it will help to clarify an otherwise confused situation.

5. References are given only when they differ from those in the Schenkling catalogue or refer to genera and species which do not appear in it.

6. Numbers preceded by a # appear throughout this work. They correspond to the list of characters and character states under the heading 'Character Descriptions' (p. 93) in the DELTA-format data file on p. 92. Numbers commencing with a 0 refer to the species included in the 'Item Descriptions' (p. 95) section in the DELTA-format data file.

7. Candèze type material. Contrary to general belief Janson did not acquire the type material of *all* the species described in Candèze's (1857–63) *Monograph* (Fleutiaux, 1945: 79; Hayek, 1973: 271). The BMNH possesses a velum-covered notebook with C. O. Waterhouse's name and the date 16th March, 1869 on the flyleaf. Waterhouse used the book for various notes including an annotated list of Elaterid types and other specimens lent to him by Janson to assist him in the identification of specimens in the Museum Elaterid collection which he rearranged in 1869 (Hampson, 1906: 551), 34 years before Janson's collection was presented to the BMNH by Godman & Salvin. The Museum also owns a manuscript list with the flyleaf annotated by C. J. Gahan to the effect that it is a catalogue of the second collection (see Lankester, 1906: 590) of Elateridae acquired from Candèze by Janson. In the text these lists are referred to as the Waterhouse and Janson lists. The type material of species based on material in Candèze's own collection but not listed in the present work should be in the IRSNB.

Terms

Holotype	A single specimen designated as the name-bearing type of a species or subspecies when it was established, or the single specimen on which the taxon was based when no type was specified.
Syntype/s	Each specimen of a type series from which neither a holotype nor a lectotype has been designated.
Syntype material	Used to show that the the original author indicated (e.g. by giving a size range, recording more than one locality or other comment) that he had more than one specimen before him at the time of the description, but did not record how many.
Type material	Used when the original author did not give any indication of how many specimens he had before him at the time of the description.

Symbols

;	A semicolon is used to show the extent of each label where this is recorded verbatim.
()	Round brackets enclosing specific names are used to distinguish cross-references from valid species.
{}	Ogee brackets enclosing specific names indicate that although no authentic material has been examined the species nevertheless merits a comment, e.g. on the date of publication or the location of the type material.
[]	Square brackets are used to indicate additional information concerning labels, such as the identification of handwriting or the colour of the label when this is of importance.
?	A question mark before the name of a collection indicates that the available evidence indicates that the material in question is believed to be in that collection but that its presence there has not been confirmed.
" "	Used to enclose data attached to a specimen where this is quoted verbatim in the text.
/	Used to separate information on both sides of a label where this is quoted verbatim.

The names of institutions, museums and collections containing material are abbreviated as follows:

ARI	Taipei, Agricultural Research Institute, Taiwan.
BMNH	London, British Museum (Natural History), England.
BPBM	Honolulu, Bernice P. Bishop Museum, Hawaii.
FMNH	Chicago, Field Museum of Natural History, U.S.A.
IP	Eberswalde, Institut für Pflanzenschutzforschung, G.D.R., formerly Deutsches Entomologisches Institut.

IRSNB Brussels, Institut Royal des Sciences Naturelles de Belgique, Belgium.
MCSN Genoa, Museo Civico di Storia Naturale, Italy.
MCZ Harvard, Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN Geneva, Muséum d'Histoire Naturelle, Switzerland.
MNHN Paris, Muséum National d'Histoire Naturelle, France.
MIZSU Turin, Museo ed Istituto di Zoologia Systematica dell' Universita, Italy
MNHU Berlin, Museum für Naturkunde der Humboldt Universität, G.D.R.
NMNH Prague, National Museum, Museum of Natural History, Czechoslovakia
NMV Victoria, National Museum of Victoria, Australia.
NR Stockholm, Naturhistoriska Riksmuseet, Sweden.
PU Lafayette, Purdue University, Indiana, U.S.A.
RNH Leiden, Rijksmuseum van Natuurlijke Historie, Netherlands.
TM Budapest, Természettudomány Museum, Hungary.
USNM Washington, Smithsonian Institution, United States National Museum, Washington, D.C., U.S.A.
ZI Leningrad, Zoological Institute, Academy of Sciences of the U.S.S.R.
ZMU Helsinki, Zoological Museum of the University, Finland.
ZMUM Moscow, Zoological Museum of the University of Moscow, U.S.S.R.
ZUM Uppsala, Zoologisk Universitets Museum, Sweden.

NOTES ON THE GENERIC DIAGNOSES AND CHARACTERS COMMON TO THE SPECIES EXAMINED

1. The generic diagnoses were prepared from the DELTA-format data file using Pankhurst's Mark 3 program for writing descriptions. The output has been lightly edited to make it easier to read. The character and state numbers have been included in the hope that by doing so it will be easier to make comparisons between diagnoses and, if necessary, to refer back to the character descriptions section of the data file (p. 93) or the key in numerical format (p. 98).

2. Some or all of the character states listed in the section entitled 'Other character states common to the species examined' which follows each generic diagnosis may also occur in the other six genera. Experience has shown that, within the *Melanotus* group, these character states may merge imperceptibly into one of the alternative states recorded in the character descriptions section of the data file (pp. 93–95). I suspect that when more material becomes available species will be found which possess the diagnostic characters of one of the seven genera considered in this work but which differ in one or more of the other character states. Until a thorough study and evaluation of these characters and their states has been carried out I do not believe they should be regarded as being of any importance above the rank of species. The character and state numbers have also been included in this section (see 1 above).

MELANOTUS Eschscholtz

Melanotus Eschscholtz, 1829: 32. Type species: *Elater fulvipes* Herbst, by subsequent designation (Westwood, 1838: 26).

Perimecus Dillwyn, 1829: 32. Type species: *Elater fulvipes* Herbst, by monotypy. [Objective synonym of *Melanotus* Eschscholtz.]

Menalotus Brullé, 1832: 136. [Inadvertent error, corrected *op. cit.*: [401].]

Cratonychus Dejean, 1833: 87. Type species: *Elater obscurus* [sensu] Fabricius, by subsequent designation (Blanchard, 1845: 76). [Unjustified replacement name for *Melanotus* Eschscholtz.]

[*Ctenonychus* sensu Melsheimer, 1845: 150 nec Stephens, 1830: 272.]

Dodecactenus Candèze, 1889: 102(36). Type species: *Dodecactenus staudingeri* Candèze, by monotypy. **Syn. n.**

Spheniscosomus Schwarz, 1892(iv): 132. Type species: *Melanotus cuneiformis* Baudi, by subsequent designation (Hyslop, 1921: 670). [Reduced to subgeneric status (as 'group 1') of *Melanotus* and the type species reduced to a variety of *M. sulcicollis* Mulsant & Guillebeau by du Buysson, 1894: 129. Thereafter there has been no general agreement as to its status, authors and cataloguers according it generic or subgeneric status according to personal preference. The most recent reference to the taxon is by Ohira & Arimoto, 1985: 47 who treat it as a subgenus.] **Syn. n.**

Sphenicosomus du Buysson, 1894: 129. [Probably an inadvertent error.]

Melanotopsis Lewis, 1894: 192. Type species: *Melanotus cete* Candèze, by subsequent desig-

nation (Sharp, 1894: 148). [Synonymized with *Spheniscosomus* by Lewis, 1896: 336.]

Cremnostethus Schwarz, 1902(i)a: 197. Type species: *Cremnostethus nigricollis* Schwarz, by subsequent designation (Hyslop, 1921: 630). [Reduced to a subgenus of *Melanotus* by Fleutiaux, 1933: 214, footnote. Treated as a valid genus by Miwa, 1934: 221 and Ohira, 1970b: 214.] **Syn. n.**

Tenalomus Fleutiaux, 1933: 234 [as a subgenus of *Melanotus*]. Type species: *Melanotus (Tenalomus) fulvipennis* Fleutiaux, by monotypy. **Syn. n.**

Kensaculus Chujo & Ohira, 1965: 24 [as a subgenus of *Melanotus*]. Type species: *Melanotus invectitus* Candéze, by monotypy. **Syn. n.**

Natomelus Dolin, 1979: 71. Type species: *Natomelus arcanus* Dolin,by monotypy. **Syn. n.**

GENERIC DIAGNOSES. Pronotum with basal lateral incisions (#7,1, Fig. 10, arrow). In ventral view posterior angles of prothorax truncate at apex (#26,2, Fig. 10a). Inner margin of hypomeron with a well-defined, narrow, completely, or almost completely, impunctate border separated from rest of hypomeron by a distinct groove or raised above it (#10,1, Figs 18, 18a) (individual exceptions known, see *pulvereus* Candèze p. 69). Inner border of hypomeron extends beyond anterior divergence point of hypomeron and prosternum forming the anterior free border of hypomeron which slopes meso-dorsad and may be concave (#29,1, Figs 18, 18a). Pronotosternal suture not situated at base of a groove (#27,2) but inner border of hypomeron may slope meso-dorsad within anterior two-thirds of its length to form a shallow channel or groove (#28,1); inner wall of groove, formed by the lateral margin of the prosternum, punctured. Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2, Figs 27, 28). Third tarsal segment simple, vertically or obliquely truncate distally; if a small ventral prolongation or lobe is present it does not extend beneath the entire length of 4th segment (#19,2, Figs 38, 39).

OTHER CHARACTER STATES COMMON TO THE SPECIES EXAMINED. In all the species examined the mesepisternum does not form part of the margin of the mesocoxal cavity (#13,1, Fig. 23)) which is made up of the mesosternum, mesepimeron and metasternum. The length of the junction between the mesepimeron and mesosternum varies from one species to another but up to the present no species has been found in which the junction is as short as in the majority of *Priopus* species (Fig. 25).

All the species also display the following character states: the nasale is simple or with a raised median area, never with a vertical carina or two confluent carinae forming an inverted 'Y' (#30,1 or 2, Figs 3–6) and antennae without a carina on one or both faces of fourth and some or all following segments (#2,2) although in a few species (e.g. *tropicalis* Champion) a smooth sparsely punctured longitudinal area on some segments may mislead the observer into believing that a carina is present. Lateral margins of prothorax each have a carina extending from posterior to anterior angle (#6,1). In the majority of species valves of ovipositor delicate, pale in colour and flexible in live or relaxed specimens (#31,1). In a few species ovipositor slightly more strongly sclerotized (entered in the data file as 31,2<moderate>) but never to the extent occurring in certain *Priopus* species (e.g. 025 *P. prominens*). Further studies are needed to decide how best to define the states of this character and to evaluate them.

COMMENTS. All states of characters 1, 3, 4, 5, 9, 11, 12, 14, 15, 16, 17, 18, 22, 23 and 24 are known to occur in species now assigned to *Melanotus*, although the degree to which they are developed differs both inter- and intraspecifically. The number of carinae on the posterior angles of the pronotum (#8) appear less subject to variation in *Melanotus* than in *Priopus*. Up to the present I have not seen any specimens in which each angle has two equally well-developed carinae (but see *phlogosus* p. 69), but many specimens show traces of a second carina either mesad or laterad of the main carina. The degree to which the inner carina is developed in the North American *communis*, *cribricollis*, *decumanus* and *similis* (016) varies from one specimen to another and may differ on the right- and left-hand side of the same individual. An indistinct inner carina is present in the Mexican *carinifer* (035). In all the specimens examined, except a few individuals of *longicornis* Candèze (? = 002 *nigricollis* Schwarz), the inner border of the hypomeron border is inclined meso-dorsad to form a groove or channel (#28,1). The depth and length of the groove or channel varies both inter- and intraspecifically; it is usually limited to the anterior third of the length of the pronotosternal suture and, in the material examined, never extends beyond the anterior two-thirds of its length. In some *longicornis* specimens the inclination of the border is so slight that it is scarcely visible and in one specimen known to me the border does not slope meso-dorsad at all. The outline of the posterior free margin of the metacoxal plate (#17), a character rarely mentioned in works on *Melanotus*, was used by Fleutiaux (1933: 206) to separate *Priopus* and *Thaumastiellus*. A preliminary examination of the

available material has shown that although in most *Melanotus* species the plate narrows gradually laterad (Fig. 32), in some species there is a small rounded protuberance and in one species known to me (035 *M. carinifer*, Fig. 33) there is a small rounded tooth at about the mid point of its length. In the majority of species the apex of the last visible abdominal sternite is bluntly arcuate (#20,3, Fig. 27); the length : width ratio of the last visible sternite may differ from one species to another and occasionally between the sexes of the same species (see sexual dimorphism, p. 60). Both sexes of two species are immediately recognisable by the appearance of the margin of the last visible abdominal sternite. In *brunnipes* (042) the middle of the apex is raised and truncate distally (#20,4, Fig. 28) and in *cuneolus* (010) there is a shallow emargination on either side of the apex of the last visible abdominal sternite (#20,2, Fig. 29). It seems probable that comparable modifications occur in other species but up till now I have not observed any in either named or unnamed material and, as far as I am aware, the feature has not been mentioned in the literature on the group.

THE HISTORY OF THE GENUS. Eschscholtz credited the name *Melanotus* to Megerle [von Muhlfeld] in whose sale catalogue (1801, not seen) it presumably appears. Apart from Latreille (1834: 158) and Westwood (1838: 26) the name remained unused for 20 years, authors giving preference to *Cratonychus* Dejean (see below). Redtenbacher (1849: 31, 294) was the first to employ *Melanotus* Eschscholtz, listing *Cratonychus* Dejean and '*Perimecus* Dillwyn & Stephens' (sic) as synonyms, and the name has continued in use since that time.

Westwood (1838) designated *Elater fulvipes* Herbst, [1806] as the type species of *Melanotus*. The identity of *fulvipes* Herbst has not been confirmed (see p. 65). Erichson (1841: 96) treated *fulvipes* as a synonym of *Cratonychus rufipes* (Herbst, 1784) and this synonymy has been accepted by subsequent cataloguers and other workers (e.g. Harold, 1869(a): 1560; Schenkling, 1927: 279; Candèze, 1860: 313; Leseigneur, 1972: 164) who were all unaware of, or chose to ignore, the fact that *rufipes* Herbst, 1784 is a junior primary homonym of *Elater rufipes* De Geer, 1774. Recent work by Leraut (1981: 98) has shown that *villosus* Geoffroy *in* Fourcroy, 1785 is the valid replacement name for *rufipes* Herbst, 1784 nec De Geer, 1774. As it has not been possible to examine the type material of the type species or of the species with which it has been synonymized, it has been assumed for the purposes of this work that synonymies are justified and that *fulvipes* Herbst is the species standing in most collections as *rufipes* Herbst. The character states for the DELTA-format data file were drawn from specimens standing as *Melanotus rufipes* Herbst in the BMNH and other collections.

Notes on the genera and subgenera placed in synonymy with *Melanotus*.

Perimecus Dillwyn. Dillwyn proposed the name for an unnamed genus-group taxon (no. 216) erected for *Elater fulvipes* Herbst by Stephens (1829: 124). Despite the fact that Dillwyn's work bears the words 'Not Published' on the title page and, as he later remarks (Dillwyn, 1848: [19]) only 'some copies were privately printed' the work has been generally, but not unanimously (Hyslop, 1921: 626), accepted as validly published.

Stephens (1830: 263) incorporated the name in his work on British insects. This work was in progress when Eschscholtz published his classification of the Elateridae in a German journal (*Entomologisches Archiv*) which Stephens (1830: 374) was unable to obtain with the result that this, and some other taxa for which he either accepted Dillwyn's names or erected himself, had already been named by Eschscholtz. *Perimecus* has the same type species as *Melanotus* and is therefore an objective synonym of the latter.

Cratonychus Dejean. The fact that Dejean listed *Melanotus* Eschscholtz as a synonym of *Cratonychus* indicates that it was his intention to replace Eschscholtz' generic name with his own. The reason why he did so is not hard to discover. Two years after the establishment of *Melanotus* by Eschscholtz, Dejean (1831: 689) used the name for two Carabid species from South America. The carabids had probably stood under *Melanotus* in his collection for so many years (although the name does not appear in the 1821 edition of his catalogue) that he saw no reason why he should defer to Eschscholtz and change the name. Dejean included 28 species in *Cratonychus*. The majority are his own, undescribed, species but he lists a number of valid names of which the first is *obscurus* Fabricius (sic, = *obscurus* sensu Fabricius, 1775, see p. 90) which he treats as the senior synonym of *fulvipes* Herbst and *castanipes* Paykull. Blanchard (1845: 76) designated *obscurus* [sensu] Fabricius (not '*obscurus* Olivier' as claimed by Arnett, 1955: 66) as the type species. The identity of *obscurus* sensu Fabricius is uncertain (see p. 90) but from the context it is clear that Dejean's interpretation is a Palaearctic species possessing the attributes of the genus *Melanotus* as defined in this work and also those of the Palaearctic taxa now known as *villosus*

Geoffroy *in* Fourcroy and *castanipes* Paykull, and specimens bearing his identification labels in the BMNH collection support this view. Present day workers still find the species difficult to distinguish (see Jeuniaux, 1955: 234) and they cannot be separated using the characters and character states listed on pp. 93–95 (see p. 58, key couplet 30). The character states for 001 *obscurus* Fabricius for the data file were drawn from specimens identified by Dejean.

As *fulvipes* Herbst, the type species of *Melanotus*, is also regarded as a synonym of *villosus* Geoffroy *in* Fourcroy (= *rufipes* Herbst of works before 1981, see p. 74) I believe *Cratonychus* and *Melanotus* should be treated as subjective synonyms.

Thomson (1859:104), unaware of Blanchard's action, designated *Elater castanipes* Paykull, 1800 as the type species, and the designation seems to have been accepted by some workers (see below).

The generic name has had a chequered career; for over 20 years *Cratonychus* was generally used (e.g. by Boisduval & Lacordaire, 1835: 631; Erichson, 1841: 89; LeConte, 1853: 473; Lacordaire, 1857: 183) in place of *Melanotus*, probably in deference to Dejean who was held in high esteem. Redtenbacher (1849: 294) listed *Melanotus* with *Cratonychus* as a synonym but in the second edition of the same work (1858: 488) he adopted the then current usage, employing *Cratonychus* and listing *Melanotus* as a synonym. Kiesenwetter (1858: 248) pointed out that the valid name of the genus is *Melanotus* and Candèze (1860: 288) discussed the matter in greater detail. *Cratonychus* then disappeared from the literature until 1956. In that year Nakane (1956: 22, pl. 3, fig. 80) referred to and figured *Cratonychus carinatus* Matsumura (sic, = *matsumurai* Schenkling, 1927: 277; the species was recently reduced to a subspecies of *castanipes* Paykull by Kishii, 1977: 32) and ten years later Chujo & Ohira (1965: 22) employed *Cratonychus* as a subgenus of *Melanotus* (with one species, *matsumurai* Schenkling) without comment. More recently Ohira & Becker (1974: 559) have employed *Cratonychus* as a subgenus of *Melanotus* to accommodate *telum* Candèze and *castanipes* Gyllenhal (the attribution to Gyllenhal would appear to be a *lapsus calami*) and Kishii (1977: 29, 32) also lists *Melanotus* (*Cratonychus*) *castanipes castanipes* Paykull and *castanipes matsumurai* Schenkling. Ohira & Becker (1974: 560) seem (the wording is obscure) to define the subgenus on the basis of the appearance of the profile of the [posterior] prosternal process (= mucro) but as the authors remark that the prosternal process of *telum* and that of *castanipes* differ and as my own investigations have shown (see above) that within the group the profile of the mucro appears in a vast number of states which merge imperceptibly into one another I do not believe that the retention of *Cratonychus* as a subgeneric taxon is justified.

Ctenonychus sensu Melsheimer nec Stephens. Melsheimer attributed the genus to Stephens listing *Cratonychus* Dej. [pars] as a synonym. He did not define the genus or indicate how it differs from *Melanotus* which he employed (1845: 152, with *Cratonychus* Dej. [pars] as a synonym) for three new American species. Melsheimer included five new American species in *Ctenonychus* all of which were transferred to *Cratonychus* by Leconte (1853) and included in *Melanotus* by Candèze (1860).

Dodecactenus Candèze. Candèze states that the genus is based on a species possessing a very remarkable combination of characters: the absence of a distinct suture between the mesosternum and metasternum (a diagnostic character of his tribe Chalcolepidiites), and pectinate claws which are characteristic of *Melanotus*. Candèze did not assign the genus to a tribe, but remarked that he believed it to have affinities with *Ypsilostethus* and *Semiotopsis*. Two years later (1891: 102 & 44) he included *Ypsilostethus* and *Dodecactenus* in the tribe Elaterites and *Semiotopsis* in the Chalcolepidiites which suggests that he no longer believed the absence of a suture between the meso- and metasternum to be of prime importance in the classification of the Elateridae. Recent work (*in litt.*) has shown that the ease with which the suture can be seen varies not only within the *Chalcolepidius* group but throughout the whole family. I believe that further studies will show that the *Chalcolepidius* group can be redefined on the basis of other characters. Examination of the available material of both species assigned to *Dodecactenus* has shown that the position of the suture between the mesosternum and the metasternum is marked by a very fine line in the chitin which is clearly visible under a high powered microscope. When Champion (1896: 446) described the second species, *guatemalensis* from Guatemala, he transferred the genus to the 'group' Melanotini but this seems to have been overlooked by Schenkling (1925: 68) who included the genus in the Chalcolepidiinae. Fleutiaux (1926: 110), apparently unaware that Champion had already done so, transferred *Dodecactenus* to the Melanotinae. As far as I am aware there have been no subsequent references to the genus in the literature.

The two species, *staudingeri* Candéze (003) and *guatemalensis* Champion (004), assigned to the

genus have a superficial resemblance to one another but examination of the available material has shown that they display remarkably different states of certain characters. These include appearance of the head (anterior margin of frons arcuate (Fig. 5), nasale without parantennal pits, 3rd antennal segment very nearly twice length of second and equal to at least three-quarters length of 4th: anterior margin of frons angled (Fig. 4), nasale with shallow parantennal pits, 3rd antennal slightly longer than second and not more than half length of 4th), the appearance of the anterior portion of inner border of hypomeron (almost imperceptibly angled meso-dorsad: distinctly angled meso-dorsad), the appearance of the elytra (striae, except first, indistinct, not impressed, apex simple: all striae seriate-punctate, impressed at base, apex crenate), the profile of the mucro (apex with short dorsal process: apex with long dorsal process).

The structure of the meso-metasternal suture of the Indian *Melanotus sulcatus* Candèze resembles that of the South American species included in *Dodecactenus* in that it is very indistinct. Studies have shown (see p. 47) that the character occurs in an immense number of states which merge imperceptibly into one another and in my opinion it is not of sufficient importance to justify the retention of the genus.

Spheniscosomus Schwarz was erected for 6 species in which the mucro and the mesosternum (from the context it is clear that Schwarz is refering to the ventral face of the mucro and posterior portion of the margin of the mesosternal groove) are horizontal. Almost 100 years ago du Buysson (1894: 129), who seems to have been aware of the degree of variation of the profile of the mucro within the group, effectively reduced *Spheniscosomus* to subgeneric status by treating it as 'group 1' of *Melanotus*. Since that time workers have been unable to agree on the rank of the taxon. Those working on the European fauna (Binaghi, 1939(vii); Leseigneur, 1972) grant it generic status while those engaged in the study of the Indomalayan and Japanese fauna (Fleutiaux, 1933; Ohira, 1966; Ohira & Arimoto, 1985) regard it as a subgenus of *Melanotus*. Examination of the available material of the six species to which Schwarz refers has shown that although in every case the posterior portion of the margin of the mesosternal groove is horizontal the degree to which the anterior portion slopes anteriad differs from one species to another. Experience has shown that within the genus as defined in this work the profile of the mesosternal groove appears in a wide range of states, from right-angled to almost horizontal (Figs 14 & 23), which merge imperceptibly into one another and further that there does not appear to be any constant relationship between the shape of the mesosternal groove and that of the mucro. I do not believe that, as at present defined, the characters are of sufficient value to justify the retention of *Speniscosomus* at either generic or subgeneric rank.

Melanotopsis Lewis was erected for two Japanese species in which the mucro is horizontal. Five years after establishing the genus Lewis synonymized it with *Spheniscosomus*, remarking that that genus was 'based on the same species and has priority'. At that time no type species had been designated for *Spheniscosomus* but both genera included *restrictus* Candèze (036).

Cremnostethus Schwarz was erected for two Indian species (*nigricollis* Schwarz (002) and *telum* Candèze) in which the mucro is sharply angled dorsad immediately behind the anterior coxae and has a short horizontal projection at the tip (Fig. 15). Examination of the *Melanotus* group on a world-wide basis has shown that the profile of the mucro appears in almost every conceivable state between horizontal, sloping posteriad-dorsad and vertical (see p. 46), suggesting that there is no justification for the retention of the taxon at either generic or subgeneric rank. The use of *Cremnostethus* at generic rank by Miwa (1934: 27, 29, 221) and Ohira (1970b: 214) was probably due to the fact that they were unaware of Fleutiaux' (1933) footnote to the effect that *Cremnostethus* should be treated as a subgenus of *Melanotus*.

Tenalomus Fleutiaux was established as a subgenus of *Melanotus* for a large species from Tonkin in which the mucro is horizontal and the elytra truncate at the apex. The value of the structure of the mucro has been discussed elsewhere (see p. 46). While it must be admitted that the appearance of the apices of the elytra of this species is very distinctive, the outline of the elytra, and especially of the apex, shows so great a degree of variation within the group that I am convinced that it is of insufficient importance to warrant the retention of the subgenus.

Kensaculus Chujo & Ohira. The authors distinguish the subgenus '... from the known subgenera of the present genus, *Melanotus* s. str., *Spheniscosomus* Schwarz, 1892 and *Cratonychus* Dejean, 1833 by the following characters: the antennae elongate, with the second and third joints small, bulbous, or the third only a little longer than the second, and the prosternal process *often* [my italics] distinctly concaved behind the procoxal cavities'. These characters have been discussed elsewhere in this work (p. 46) and

rejected as characters of value at the genus-group rank.

Natomelus Dolin. The author comments that the genus occupies an intermediate position between *Melanotus* and *Neodiploconus*. He states that it can be distinguished from *Melanotus*, which it resembles more closely, by (translated from the Russian) 'the presence of a tooth on [the posterior free margin of] the metacoxal plate' and from *Neodiploconus* (*Priopus* of this work) by 'the different structure of the frons, the short clypeus [= narrow nasale], *the presence of basal grooves on the pronotum and the fact that the pronoto-sternal suture is open in the anterior third of its length* [my italics]'. I believe that the reference to the 'open' pronotosternal suture indicates that the hypomeron is bordered and the border angled meso-dorsad anteriorly. As the presence of posterior lateral incisions on the pronotum and the presence of a band in the inner margin of the hypomeron are two of the chief diagnostic character states of *Melanotus* as defined in this work, and the other characters mentioned occur, developed to a greater or lesser degree, throughout that genus, I have no hesitation in placing *Natomelus* in synonymy with *Melanotus* despite the fact that I have been unable to examine the type material. Dolin remarks that the aedeagus differs from that of *Melanotus* species in that the lateral lobes lack apical barbs. A number of species from the Nearctic, Palaearctic (e.g. *morbosus* Candèze from Turkestan) and Indomalayan regions also lack apical barbs on the lateral lobes of the aedeagus (see p. 75). All those species which I have been able to examine, with the exception of *malaisei* from Burma and *carinifer* from Mexico, differ from the description of *Natomelus* in that there is no tooth on the posterior margin of the metacoxal plate. In both *malaisei* and *carinifer* (035, Fig. 33) there is a small but distinct, rounded projection very near the mid point of the length of the posterior margin of the plate.

Sexual dimorphism. In many species there is no conspicuous sexual dimorphism. Some display a type common in the Elateridae in that the males are shorter and more slender and have longer more strongly serrate antennae, often clothed with longer, denser setae than the females. A few species display a marked sexual dimorphism in the appearance of the last visible abdominal sternite. In *M. brunnipes* (Germar) males the posterior half is strongly raised in the mid line and truncate at the apex (Fig. 28) while that of the female is feebly raised and arcuate at the apex. In some species the apex of the 5th abdominal sternite of the male is more strongly convex and more densely pubescent than that of the female. A longitudinal depression limited inwards by a dense fringe of setae lying on either side of the mid line distinguishes male *tropicalis* (Champion) and feeble depressions on either side of the mid line are characteristic of *staudingeri* (Candèze) (003) and *guatemalensis* (Champion) (004) males.

Distribution. Representatives of the genus have been recorded from all parts of the world except New Zealand. The largest number of species is found in the Oriental and Nearctic regions and the fewest in the Afrotropical (2 species, *agriotoides* Candèze and 040 *umbilicatus* Gyllenhal), Neotropical (2 species, *simplex* Germar (= *communis* Gyllenhal) and *striatus* Guimarães, 1933) regions and Australia where the genus has only recently been discovered (015 *mouldsi* Calder, 1983).

Biology and habits. Little is known of the habits of the adults. Some species feed on nectar and in so doing may cause damage to the flowers of fruit trees (Horion, 1953: 240–244). The larvae of a number of species have been described (see Gaedike, 1969, 1975, 1979). Some live in decaying wood and are predacious though they may also obtain some nutriment from the wood (Horion, *loc. cit.*). Others live in the ground and are known to cause damage to the roots of cereal, forage and other crops in the Palaearctic (Dolin, 1978), Indomalayan (Miwa & Yanagihara, 1929) and Nearctic (Hyslop, 1915; Riley & Keaster, 1979) regions. A useful review of the species of agricultural importance can be found in Blunk (1954). In a recent paper Riley & Keaster (1984) suggest that the occurrence of *Melanotus* larvae in and under bovine manure pats could be a useful indicator of possible wire-worm infestations in pastures intended for conversion to row crop production.

An annotated list of *Melanotus* species examined and notes on some other species

The Schenkling (1927) catalogue lists over 200 valid species and almost 100 nominal species as synonyms in the six nominal genera now included in *Melanotus*. Over 100 species have been described since the publication of the catalogue.

In the course of the present study some 125 nominal species have been examined. One species, *nitidus* Candèze, is transferred to *Priopus*.

For notes on the conventions, terms, symbols and abbreviations used in this list see p. 53.

It is hoped that this list will serve more than one purpose, viz: to record the species examined in the course of this study so that future workers may verify the conclusions reached; to record the type

and other material preserved in the BMNH and make available scattered information concerning type material in other institutions; to draw attention to the true date of publication of several works; to correct erroneous lectotype designations; to clarify the geographical position of some type localities.

Unless there is a statement to the contrary, interpretation of the species is based on examination of a male.

NOTE. Unfortunately Quate & Thompson (1967) do not give reasons for many of their decisions concerning the status of type material, new synonymies and extractions from synonymy and it is often difficult, if not impossible, to discover whether the synonymies they present are new or should be credited to an earlier worker. The dates given for lectotype designations are often those on the label attached to the specimen and do not refer to a publication. Comments have been included in those cases where I believe they may be of use to anyone engaged in a study of the group.

{*abdominalis* (Erichson, 1841 not 1842, see references}

Quate & Thompson (1967: 70) are of the opinion that the specimen standing as the type in the MNHU is not North American and has been labelled in error. As the description was based on an unrecorded number of specimens the status of the specimen is that of probable syntype.

acuminatus Reitter. Type material (?TM).

aemulus (Erichson). Holotype ♂ (?MNHU).

agriotoides Candèze, 1 ♀ syntype. ♂ unknown.

albernus Candèze. Holotype ?sex (?MCSN). (008)

albertisi Candèze. Lectotype ♀, designated by Van Zwaluwenburg (1959: 936) (MCSN).

As Candèze remarks that numerous specimens were found it seems probable that there may be more paralectotypes (?IRSNB) than the 3 paralectotypes (not cotypes) (MCSN) recorded by Van Zwaluwenburg (1959: 396).

The aedeagus, which is unusual in that it has both basal and apical barbs, is figured by Van Zwaluwenburg (1948: 276, fig. 6). The aedeagus of *guambatae* is similar.

Anterior aspect of head Fig. 6.

albivellus Candèze, 1 ♀ syntype. ♂ unknown.

{*altercuneolus* **nom. n.**}

{*cuneolus* Schwarz, 1902(vii). 1 syntype (IP, recorded by Gaedike, 1985: 28). Junior primary homonym of *cuneolus* Candèze, 1860.}

The geographical position of the type locality, Liangagas, Soekaranda (sic) is unknown. There are several villages with the name Soekarandja in Sumatra.

Schwarz' use of the name *cuneolus* for a *Melanotus* species must be due to an oversight as he was clearly familiar with Candèze' work. The explanation may be that he had already prepared the manuscript for the *Genera Insectorum*, published 4 years later (1906: 185), in which he included *cuneolus* Candèze in *Spheniscosomus*.

americanus (Herbst). Lectotype ♂ (ZMHU), designated by Quate & Thompson (1967: 53) not Quate (1960), see note above.

{*angustatus* Erichson. Lectotype ♀ (ZMHU), designated by Quate & Thompson (1967: 53) not Quate (1960), see note above. [Synonymized by Quate & Thompson, 1967: 52.]}

The lateral lobes of the aedeagus lack apical barbs(see *annosus* group p. 75).

annosus Candèze, 1 ♀ syntype (033).

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

{*arcanus* (Dolin, 1979: 72, figures of the dorsal aspect of whole beetle, antenna, last visible sternite and aedeagus) (*Natomelus*) (019). TADZHIKSTAN. **Comb. n.**}

Although I have been unable to examine the type I am convinced that the transference to *Melanotus* is justified. See discussion on p. 60. The lateral lobes of the aedeagus lack apical barbs (see *morbosus* p. 68 and *annosus* group p. 75).

{*armeniacus* Schwarz, 1892(iii): 365 not 1891, see references. 2 ♂ syntypes (IP, recorded by Gaedike, 1985: 19).}

{*avitus* Candèze. Syntype material (?IRSNB).

Candèze received the material from L. van Heyden whose Palaearctic Coleoptera were acquired by the IP, Eberswalde (Horn & Kahle, 1935: 112). As the species is not recorded by Gaedike (1985) it must be assumed that Candèze did not return any specimens to van Heyden.

bipunctatus Candèze, lectotype (not type) ♂, designated by Van Zwaluwenburg (1959: 396).

brevis Candèze, 1882 not 1881, see references. Type material (?IRSNB).

brunnicornis Schwarz. 1 syntype (IP, recorded by Gaedike, 1985:24).

brunnipes (Germar). Germar credits the species to Megerle [1801] but almost certainly based his description on material in his own collection. (042)

The location of Germar's type material is unknown, but some of it may have been acquired by the BMNH with the Janson collection (see Hayek, 1973: 275). The BMNH collections contain 2 ♂, 1 ♀ from Hungary (one of the type localities) recorded as *brunnipes* Meg. in

the manuscript catalogue entitled *Catalogus Elateridum collectionis Schaumii*. Despite the fact that none of the specimens bears a Germar determination label I believe that these specimens may well have formed part of Germar's syntype series.

Ventral aspect of left-hand side of prothorax, Fig.18; last visible abdominal sternite Fig. 28.

candezei Schwarz, 1902(i)b not 1901, see references. 2 syntypes (IRSNB & IP recorded by Gaedike, 1985: 24).

[*rubidus* sensu Candèze, 1860: 327 nec Erichson, 1841]

Cratonychus rubidus Erichson was transferred to *Diploconus* (= *Priopus*) by Schwarz (1902(i)b: 328), see p. 84.

Schwarz remarks that M. Severin [curator at the IRSNB, Brussels] sent him this species, identified as *M. rubidus* Erichson, from the Candèze collection. As Schwarz records a size range he must have seen more than one specimen, but whether they all came from the Candèze collection or whether he owned or examined additional material is unknown. Interpretation of the species is based on a ♂ determined as *rubidus* by Candèze and acquired with the Janson collection. Although the specimen measures 11 mm compared with the published length of 14–15 mm it agrees well with Candèze' description and, as Schwarz remarks, bears a strong resemblance to *puberulus* Erichson. The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

Whether this is the Javanese pest to which Reh (1912) and Blunk & Muhlmann (1954) refer is unknown (see p. 52).

carinatus Candèze, lectotype ♂, designated by Van Zwaluwenburg (1959: 397).

The aedeagus is distinctive in that the lateral lobes are short and lack apical barbs and the median lobe relatively long, equal to about one-third of the length of the aedeagus. See *annosus* and *imitans* groups, pp. 74, 75.

carinifer Champion, 1896 not 1895, see references, holotype ♂. (035)

The apex of each lateral lobe, which is enlarged but not distinctly barbed, resembles those of *americanus* and *cribriventris* figured by Quate & Thompson, 1967: 77, figs 6j & k.

Posterior coxal plate Fig. 33.

castanipes (Paykull). Quate & Thompson (1967: 22) remark that 3 ♂ & 2 ♀ in the NR, Stockholm may be the 'types' [= syntypes] but question their validity. The matter clearly requires further investigation.

As far as can be ascertained two of the following five species were first synonymized with *castanipes* by Quate & Thompson (1967: 8, 14). It also appears that Quate & Thompson, who had the opportunity of examining the type material of the other two species which were previously either provisionally (*inaequalis*) synonymized with *castanipes* or whose synonymy with that species was not generally accepted (*scrobicollis*), should be credited with the confirmation of the synonymies.

{*paradoxus* Melsheimer, 1845 not 1846, see references. Lectotype ♀ (MCZ), designated by Quate & Thompson, 1967: 22. [Synonymized by Quate & Thompson, 1967: 8,22, see above.]}

{*longipennis* Küster. ♂ & ♀ syntypes (location unknown, probably lost, Horn & Kahle, 1935: 144). [Synonymized by Kiesenwetter, 1858: 251.]}

{*inaequalis* LeConte. Lectotype ♀ (MCZ), designated by Quate & Thompson (1967 not 1962, see note p. 61). [Candèze' (1860: 311) tentative synonymy, which appears to have been accepted by most subsequent cataloguers (but not Thomas, 1941: 258), confirmed by Quate & Thompson (1967: 7 & 22), see above.]}

{*scrobicollis* LeConte. Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 23 not 1962, see note p. 61). [Henshaw's (1895: 19) synonymy, accepted by American cataloguers but not by Schenkling (1927: 289), confirmed by Quate & Thompson (1967: 8, 22, see above).]}

texanus Candèze, lectotype (not holotype) ♀, designated by Quate & Thompson (1967: 23). [Synonymized by Quate & Thompson, 1967: 8, 22, see above.]

{*castanipes matsumurai* Schenkling}

{*carinatus* Matsumura, 1911 [publication not seen]. Type material (?Sapporo University). Junior primary homonym of *carinatus* Candèze, 1865. [Reduced to subspecific status by Kishii (1977: 32).]}

caudex Lewis, 2 ♂, 2 ♀ syntypes.

Chujo & Ohira's (1965: 25) synonymy of this species with *fortnumi* Candèze (q.v.) is puzzling since they (1965: 24) include *caudex* Lewis, 1879 in the list of species to be transferred to *Kensakulus*. It seems probable that they intended to cite *caudex* sensu Sakurai (1942: 4) nec Lewis from Hokkaido, which was synonymized with *fortnumi* by Ohira (1958: 69).

cete Candèze, 2 ♀ syntypes. (006)

amussitatus Candèze, 3 ♂, 3 ♀, 2 ?sex syntypes. [Synonymized by Lewis, 1894: 192.]

chiricahuae Knull, 1962: 52, fig. 1 [aedeagus]. Holotype ♂, allotype and unrecorded number of paratypes, ARIZONA from the Knull collection (FMHN). Paratypes from the M.C. Lane collection in University of Massachusetts

collection and/or Smithsonian Institution, USNM (Moffitt, 1976)

The lateral lobes of the aedeagus are very short and the median lobe projects a long way beyond their apices (see *imitans* group p. 74).

cladestinus (Erichson, 1841 not 1842 see references). Lectotype ♂ (MNHU), designated by Quate & Thompson (1967: 32) not Quate (1960), see note p. 61. (009)

{*peninsularis* Candèze, 1889: 112(46). Lectotype ♂ (IRSNB), designated by Quate & Thompson (1967: 32) not Quate(1960), see note p. 61. [Synonymized by Quate & Thompson, 1967: 32.]}

{*perplexus* Blatchley. Lectotype ♂ (not holotype), designated by Quate & Thompson (1967: 32). (PU).}

The description was based on two specimens.

As far as can be ascertained this synonymy should be credited to Quate & Thompson (1967: 8, 32), see note p. 61.

The lateral lobes of the aedeagus lack apical barbs(see *annosus* group p. 75).

comatus Candèze. 3 syntypes (?MCSN, ?IRSNB).

communis (Gyllenhal). Lectotype ♂ (NR), designated by Quate & Thompson (1967: 25) not Quate (1962), see note p. 61. The aedeagus is figured by Quate & Thompson (1967: 75, fig. 4j).

simplex Germar. [Synonymized by Erichson, 1841: 102 who based his interpretaton of the species on the 'Original-Exemplare' (i.e. syntypes).]

Interpretation of the species is based on a ♀, labelled: 'simplex m. communis var. St Paulo 711* [Germar]; Coll. Janson, ex Schaum.' Whether the specimen is part of the syntype series is uncertain. For a note on the history of the Germar collection see Hayek (1973: 275). The species is not mentioned by Quate and Thompson (1967), presumably because of its Brazilian origin. There were no more records of *Melanotus* species from Brazil until Guimares (1933: 20) described *striatus*.

See also *paganus* Candéze which Quate & Thompson (1967: 8, 24) treat as a synonym of *communis* and *spadix* Erichson which they (1967: 18) extract from synonymy with the same species.

{*concisus* Knull, 1959: 281. Holotype ♂ and an unrecorded number of paratypes, NEW MEXICO, from the Knull collection (FMNH). 1 ♂ paratype from the M. C. Lane collection in University of Massachusetts collection or Smithsonian Institution, USNM (Moffitt, 1976).}

conicus Candèze. Holotype ♂ (?MCSN).

correctus Candèze, 1 ♂ syntype. It is possible that additional specimens are preserved in the IRSNB.

corticinus (Say), ♂ determined by Candèze.

{*glandicolor* Melsheimer, 1845 not 1846, see references. Lectotype ♀ (MCZ), designated by Quate and Thompson (1967: 40 not 1962, see note p. 61).}

As far as can be ascertained the synonymy should be credited to Quate & Thompson (1967: 8, 39), see note p. 61.

{*vetulus* Erichson, 1841. Lectotype (not holotype) '♀ (MNHU) designated by Quate and Thompson (1967: 40). [Synonymized by Quate & Thompson, 1967: 39.]

As the type material of *corticinus* is lost (Quate & Thompson, 1967: 40) it follows that interpretation of the species is subjective. A specimen bearing Candèze' determination label (presumably acquired after 1860 as at that time (1860: 360) it appears among the species unknown to him) agrees reasonably well with Quate & Thompson's (1967: 39) description.

crassicollis Erichson. Type material (?MNHU).

(*cribricollis* Candèze, 1860)

Junior secondary homonym of *cribricollis* (Faldermann, 1835). See *sestrotrachelus* **nom. n.**

{*cribricollis* (Faldermann, 1835). Holotype, 'China borealis' (?ZI).}

This species, which was originally included in *Ludius*, was transferred to *Spheniscosomus* by Yacobson (1913: 754). As Faldermann does not mention the claws in the description and, as far as I am aware, does not mention any other character which would justify the transference to *Spheniscosomus*, it seems reasonable to assume that Yacobson, who lived in St. Petersburg (now Leningrad), was able to examine the type.

cribrosus (Champion, 1896 not 1895, see references), 1 ♂, 3 ♀ syntypes.

cribulosus (LeConte). Lectotype ♂, designated by Quate & Thompson (1967: 39 not 1962). See note p. 61.

The lateral lobes of the aedeagus, figured by Quate & Thompson (1967: 76, fig. 5j), lack apical barbs (see *annosus* group p. 75).

(*cuneiformis* Baudi, type species of *Spheniscosomus*, see *sulcicollis* Mulsant & Guillebeau p. 73.) (028)

cuneolus Candèze, 1 ♂, 1 ♀ syntypes. (010)

Last visible abdominal sternite Fig. 29.

{*cuneolus* Schwarz, 1902(x). Junior primary homonym of *cuneolus* Candeze, 1860.} See {*altercuneolus* **nom.n.**.}

decumanus (Erichson). Lectotype (not holotype),

♂ designated by Quate & Thompson (1967: 20) (ZMHU).

{*cuneatus* LeConte. Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 21 not 1962, see note p. 61). [Horn's (1879: xvi) tentative synonymy confirmed by Quate & Thompson, 1967: 20.]}

{*incertus* LeConte. Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 21 not 1962, see note p. 61). [Horn's (1879: xvi) tentative synonymy confirmed by Quate & Thompson (1967: 20).]}

canadensis Candèze, lectotype (not holotype) [?]♂ (abdomen lost), designated by Quate & Thompson (1967: 20).

As far as can be ascertained the synonymy should be credited to Quate & Thompson (1967: 7, 20), see note p. 61.

densus Fleutiaux, 1933: 228, 1 ♂ syntype, NORTH VIETNAM: Chapa (*Jeanvoine*).

Additional syntypes (?MNHN).

depressus (Melsheimer, 1845 not 1846, see references). Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 35 not 1962, see note p. 61). (011)

{*parumpunctatus* Melsheimer, 1845 not 1846, see references. Lectotype ♀ (MCZ), designated by Quate & Thompson, 1967 not 1962, see note p. 61.}

Quate & Thompson's (1967: 36) remark that 'The type of *parumpunctatus* appears to us to be *depressus* ...' confirms Van Zwaluwenburg's tentative synonymy quoted by Blatchley (1927: 142) 40 years earlier.

The lateral lobes of the aedeagus, figured by Quate & Thompson (1967: 76, fig 5i), lack terminal barbs (see *annosus* group p. 75).

{*despectus* Candèze}

As this species cannot be found in the BMNH collections and as it does not appear in either Janson's or Waterhouse's lists (see p. 54) I would expect the material to be in the IRSNB collections (see p. 54). Quate & Thompson (1967: 70) refer to Lane's (*in litt.*) comment that there are two specimens in the IP, Eberswalde 'which might be the types', but the species is not recorded by Gaedike, 1985. When Candèze does not record the owner of the specimens I have till now assumed, with I believe some justification (Hayek, 1973: 271), that the material was in his own collection.

dichrous (Erichson). Type material (?MNHU).

dilaticollis Reitter. ♂ & ♀ syntype material (?TM).

dispunctatus Candèze, 1897 not 1896, see references, lectotype ♀, designated by Van Zwaluwenburg (1959: 397), 12 mm not 11.5 mm; paralectotype ♂, Java, Preang. (12.5 mm) (IRSNB).

The published locality is 'Java occidental' and the length is recorded as 13 mm. The lectotype carries the locality Tsikorai (? Mt. Chikorai, 7°13′ S 107° 11′ E), Preanger (District) which is in W. Java. It also carries Candèze' yellow-bordered card label (see *immissus* below) 'n. sp. 1893, dispunctatus Java'. Whether the two additional specimens to which Van Zwaluwenburg (*loc. cit*) refers (1 ♀, Java (*Früstorfer*) [collected there 1891–94] (13 mm) and 1 ♂, Java, Clem [illegible ms.] (11 mm) were part of Candèze' original material is open to doubt. All are conspecific.

The lateral lobes of the aedeagus lack terminal barbs (see *annosus* group p. 75).

ebeninus Candèze, 1 ♀ syntype, PHILIPPINES: Manille (*Chevr[olat]*).

Fleutiaux (1914: 448) remarks that he possesses a 'type' from the Chevrolat collection (?MNHN, Fleutiaux collection).

The lateral lobes of the aedeagus of specimens believed to be conspecific with the syntype are furnished with apical barbs, but the proximal part of the barb lies so close to the shaft at a point about one-third of the distance from the apex that, unless closely examined, the lateral lobes appear to lack barbs.

According to Ohira (1973(xii): 8) this species is closely allied to *palawanensis*. In addition to the differences recorded by Ohira it would appear that the species also differ in the structure of the aedeagus.

egens Candèze. ♂ unknown.

The description is based on an unrecorded number of specimens from 'Indes Orientales' (see *Metriaulacus badiipennis* p. 76). As the species does not figure in either Waterhouse's or Janson's lists (see p. 54) it may be in the IRSNB.

elongatus (Hope, 1831: 25) (*Elater*), 1 ♀ syntype, NEPAL: Nepal [yellow paper]; elongatus Hope [?Hope]; Melanotus elongatus Hope (Elater) Type [?Gahan]; 4053 [probably erroneous, see below]. **Comb. n.**

The four-figure number refers to volume 13 of a quarto manuscript catalogue entitled *Annotated copy of Ms. Catalogue of Coleoptera Coll.* (circa 1842) in the possession of the BMNH. It is almost certainly erroneous as it refers to *Telephorus rubricollis* Hope and the collection contains a specimen of this species with the number 4053 attached to it. *Elater elongatus* Hope from the Hardwicke collection is recorded as number 4033 in volume 12.

This species has not been cited in any

work since the original description. ♂ unknown.

{*elongatus* (Schwarz, 1902(x)). Junior secondary homonym of *elongatus* (Hope, 1831). See *prolatus* **nom. n.**}

erythropygus Candèze, 5 ♂, 3 ?sex syntypes.

Only one male carries the type localty Hiogo, but experience has shown that Lewis did not attach locality labels to every specimen in a series. 4 ♂,1 ?sex were acquired directly from Lewis, the remainder with the Janson collection. In view of the fact that Candéze had a large number of specimens before him at the time of the description there may be unrecognized syntypes in the BMNH and other collections.

fairmairei Fleutiaux. Syntype material (?MNHN).

{*ferrugineus* Schwarz, 1892(iii): 366 not 1891, see references. 1 ♂ syntype (IP, recorded by Gaedike, 1985: 34).}

Schwarz remarks that the anterior tibiae are strongly compressed and slightly curved.

{*flavohirtus* Candèze, 1897 not 1896, see references. Type material (?IRSNB).}

{*fortis* **nom. n.**}

{*robustus* (Szombathy, 1910(vii). Type material (?TM). Junior secondary homonym of *robustus* (Erichson, 1841).}

fortnumi Candèze. Type material (?IRSNB).

The species was extracted from Lewis's (1894: 193) (provisional) synonymy with *invectitus* Candèze by Ohira (1958: 69) who also listed *caudex* sensu Sakurai (1942: 4) nec Lewis (1879) as a synonym.

frequens (Miwa, 1930: 61). Syntype material (?ARI, see p. 106).

Described as *Spheniscosomus* the species was transferred to *Melanotus* (*Sphensicosomus*) by Ohira (1966: 331).

The lateral lobes of the aedeagus, figured by Ohira (1966: 333, figs 44, 45), bear apical barbs.

fulvipennis (Fleutiaux, 1933: 234) (*Melanotus* (*Tenalomus*)), holotype ♀, VIETNAM: Mieville [geographical position unknown] 1923 (MNHN). **Comb. n.** (031)

See p. 59. The ♂ is unknown.

{*fulvipes* Herbst, 1806 (*Elater*). Type material (?ZMHU). (007)}

The type species of *Melanotus*, it was synonymized with *rufipes* Herbst, 1784 by Erichson (1841: 96). Cataloguers and other workers have accepted the synonymy and the name *rufipes* was until recently in current use but only the examination of the type material will show whether it is justified.

Elater rufipes Herbst is a junior primary homonym of *E. rufipes* De Geer, 1774 (= *Prosternon tesselatum* (Linnaeus, 1758), see Hayek, 1979: 185). Leraut (1981: 98) has shown that the valid name for *rufipes* Herbst nec Degeer is *villosus* (Geoffroy *in* Foucroy), see p. 74. See also *obscurus* sensu Fabricius p. 90.

The character states for the DELTA-format data file (007, p. 96) were drawn from specimens standing as *Melanotus rufipes* Herbst in the BMNH and other collections.

fusciceps (Gyllenhal). Type material (?NR).

fusciceps torosus (Erichson). Type material of *torosus* (?ZMHU).

It would appear that Schwarz (1892(viii): 147 & 163) reduced *torosus* to subspecific status because, in his opinion, the shape of the aedeagus falls within the range of variation of the aedeagus of *fusciceps*.

{*fuscus* (Erichson), see *hirticornis* (Herbst).}

{*fuscus* Fabricius sensu auctorum, see *hirticornis* (Herbst)}

guambatae Van Zwaluwenburg, 1933: 184. Holotype ♂, SOLOMON IS (BPBM). (012)

The aedeagus, which is unusual in that the lateral lobes have both basal and apical barbs, is figured by Van Zwaluwenburg (1948: 276, fig. 5). The aedeagus of *albertisi* is similar.

guatemalensis (Champion, 1896 not 1895, see references) (*Dodecactenus*), 9 ♂, 3 ♀ syntypes. **Comb. n.** (004)

The median lobe of the aedeagus projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group, p. 74)

Anterior aspect of head Fig. 4; mucro Fig. 14.

haemorrhous Candèze, 1 ♂ (labelled 'nov. sp.' by Candèze), 2 ♀ syntypes (one with Dejean's determination label, one with that of Candèze); all three are from the Dejean collection.

The anterior, and especially the middle, femora are compressed and the tibiae compressed and curved.

A fourth ♀ specimen from the Candèze collection labelled: 'Melanotus haemorrhous, Coromand. Deyr.' [Candèze yellow-bordered label] agrees well with the description of var. a. The variety differs from the 3 syntypes in that the antennae and legs are dark brown instead of red-brown, the meso- and metafemora not distinctly flattened and the parantennal pits large. In my opinion the variety is not conspecific with the syntype series. I do not know the species to which it belongs.

{*hamatus* Knull, 1959: 280. Holotype ♂, allotype and paratype, TEXAS, from the Knull collection (FMNH). Unrecorded number of paratypes from the M. C. Lane collection in the University of Massachusetts collection and/or the Smithsonian Institution, USNM (Moffitt, 1975).}

Quate & Thompson's (1967: 59, fig. 7d) remark 'paramere with a peculiar winglike flap on venter near centre and without apical blade' is misleading. The figure shows a structure bearing some resemblance to the aedeagus of *ruficaudis* (see p. 71).

hapatesus Candèze. Holotype ?sex (?RNH. ?IRSNB). (014)

The specimen was collected during an expedition to Sumatra in the years 1877 to 1879 under the auspices of the Aardrijkundig Genootschap, Amsterdam led by A. L. van Hasselt and J. F. Snelleman.

{*heydeni* Schwarz, 1892(iii): 367 not 1891, see references. 1 syntype (IP, recorded by Gaedike, 1985: 38).}

hauseri Dolin, 1971: 368, 5 ♂ syntypes, TADZHIKISTAN: Karatag (sic) [32° 31′ N 68° 20′ E, about 200 km SE. of Samarkand] (ex Hauser coll.) and 1 ♀ syntype (not paratype) Muminabad, presented by Dolin.

Dolin does not appear to have designated a holotype.

hirtellus Candèze, 1 ♀ syntype. ♂ unknown.

hirticornis (Herbst, 1806). Type material (possibly MNHU, see below). [Synonymized with *fuscus* sensu auctorum (as *fuscus* Fabricius) by Harold, 1869(a): 1559. Recognized as a senior synonym of *fuscus* Erichson, 1841 by Van Zwaluwenburg, 1959: 397.]

fuscus sensu auctorum, nec Fabricius, 1801.

{*fuscus* Erichson, 1841. Lectotype ♂ (MNHU), designated by Van Zwaluwenburg (1959: 397) not Delkeskamp. [Tentative synonymy with *fuscus* sensu auctorum [as *fuscus* Fabricius] in Candèze, 1860: 335 and as a synonym without comment in Candèze, 1888: 683.]}

Erichson's diagnosis and text leave the reader in no doubt that he was describing a new species, not redescribing *fuscus* Fabricius.

This is the species recorded as *Melanotus fuscus* Fabricius, 1801 in the Schenkling catalogue (1927: 23). Examination of the type material has shown that *Elater fuscus* Fabricius is an *Agrypnus* species (Van Zwaluwenburg, 1959: 351; Hayek 1973: 157). The belief that the species belongs to the *Melanotus* group can be traced to Eschscholtz (1829: 32) and Dejean (1833: 87) who included it in *Melanotus* and *Cratonychus* respectively.

Examination of the specimens standing as *M. fuscus* Fabricius in the BMNH, many of which were identified by the owners of the collections from which they came, indicates that there is a general consensus of opinion regarding the identity of the species. Whether the name *hirticornis* is correctly applied to this species requires confirmation. As far as I can discover the *fuscus* Fabricius [= *fuscus* sensu auctorum] – *hirticornis* Herbst synonymy first appeared in Gemminger & Harold's catalogue (Harold, 1869(a): 1559). The type material of *hirticornis* Herbst has not been located but in my opinion it is not beyond the bounds of possibility that the two specimens in the MNHU bearing the number 17042 recorded by Van Zwaluwenburg (1959: 397) are all that remain of the type material of both *fuscus* Erichson ***and*** *hirticornis* Herbst. The basis for this belief is that Gerstaecker, who was curator at the MNHU between 1853 and 1887, is known to have relabelled many old specimens in the course of rearranging the collection (Königsmann, 1970). Personal knowledge of the appearance of Erichson and Gerstaecker labels and the fact that in Horn & Kahle (1935–7) the caption to pl. 11, no. 9 erroneously attributes Gerstaecker's label to Erichson (the correction appears in the index on p. 517) leads me to believe that the label 'Fuscus Fab.ˆ E. hirticornis Ht. Bengale Hind.' mentioned by Van Zwaluwenburg (1959: 397) was wrongly identified as Erichson's and is really that of Gerstaecker. In my opinion the wording on the label recording the *fuscus* Fabricius – *hirticornis* Herbst synonymy, which almost certainly did not appear until 1869 (see above), 20 years after Erichson's death but within the period during which Gerstaecker was active, lends support to my belief.

I suspect that further studies may show that *M. punctosus* Walker (p. 71) is conspecific with *hirticornis*.

ignobilis (Melsheimer, 1845 not 1846, see references). Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 34 not 1962 see note p. 61).

For information on the Melsheimer collection see Hagen (1884).

{*secretus* LeConte. Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 34 not 1962, see note p. 61). [Synonymized by Quate & Thompson, 1967: 8 & 33.]}

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

imitans Van Zwaluwenburg, 1963: 342, pl. 14, fig. 11 (aedeagus). Holotype ♂, allotype, PAPUA NEW GUINEA (BPBM).

The lateral lobes of the aedeagus figured by Van Zwaluwenburg and Calder (1983: 159, fig. 8) are short (see *imitans* group p. 74).

immissus Candèze, 1897 not 1896 see references, 3 syntypes, JAVA: 2 ♂ Préang., 1 ♀ Préanger (IRSNB). Van Zwaluwenburg's (1959) lectotype designation is not valid (see below).

Van Zwaluwenburg (1959: 398, pl. 2, fig. 24, aedeagus) designated and labelled the 'first of 4 [specimens labelled] Type' as the lectotype. Unfortunately there can be no doubt that the specimen he selected was not part of the original syntype series. Not only does it not agree with the description as well as those recorded above but the locality label reads 'Java Ogist. [?, unknown illegible ms.]'. Van Zwaluwenburg was probably misled by the fact that a yellow-bordered card label bearing the words '1894 immissus Cand. Java Préangers' in Candèze' hand is also attached to it. It is known that Candèze used card labels in his collection and that these were later (probably when the collection was acquired by the IRSNB) attached to one of the series which they marked. The three syntypes are conspecific. Van Zwaluwenburg's lectotype belongs to a species unknown to me.

infaustus (LeConte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 51 not 1962, see note p. 61).

insipiens (Say, 1825)

American cataloguers (Leng, 1920: 124; Blackwelder, 1974: 50) have recorded the date of publication as 1839 but the first, longer, description appeared in 1825.

{*tenellus* Erichson. Lectotype ♀ (NMHU), designated by Quate & Thompson (1967: 66) not Quate (1960), see note p. 61). [Synonymized with *insipiens* by Horn, 1879: xvi.]}

As the type material of *insipiens* is believed lost (Quate & Thompson, 1867: 66) the interpretation of the species is, of necessity, subjective. It follows that the synonymy must be considered provisional.

Interpretation of the species is based on a male labelled *tenellus* by Candèze which also carries Dejean's label with the name 'egenus' to which Candèze (1860: 362) refers.

insularis Candèze. Type material (?IRSNB). ♂ unknown.

{*interjectus* Candèze, 1897 not 1896, see references. Type material (?IRSNB and possibly other collections as the material was submitted by the dealer Staudinger).}

invectitus Candèze. Holotype ♂ (?IRSNB, ?ZMU). (032)

labidus (Erichson), 1 ♀ syntype, labelled 17054 (MNHU). ♂ unknown.

laevis (Champion, 1896 not 1895, see references), 4 ♂, 4 ♀ syntypes.

lanceatus Quate & Thompson (1967: 37), ♂ determined from description by the writer.

lanuginosus (Champion, 1896 not 1895, see references), holotype ♂.

The median lobe of the aedeagus resembles that of *sestrotrachelus* in that it projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see imitans group p. 74).

legatus Candèze. Type material, coll. Guérin-Méneville (?IRSNB).

The anterior and middle femora and tibiae of both sexes are laterally compressed (Fig. 39). Candèze (1873: 21) described the tibiae, which are curved as well as compressed as 'falciform'.

leonardi (LeConte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 67 not 1962, see note p. 61).

Despite the fact that in their description Quate & Thompson (1967: 66) remark that the mandibles are without a pit they include (*op. cit.* :7) the species in the *americanus* group whose distinguishing feature is that a pit is visible on the mandible. A specimen in the BMNH determined by E. C. Becker lacks a pit on the mandible.

lewisi Schenkling, 1927. [Replacement name for *longipennis* Lewis.] (039)

longipennis Lewis, 1894, 2 syntypes, 1 ♂, Kioto, 1 ♀, Kobe. [Junior secondary homonym of *Cratonychus longipennis* Küster (1848) which was synonymized with *castanipes* Paykull (1800) by Kiesenwetter (1858: 251).

The anterior and middle femora and tibiae resemble those of *legatus* (see above).

longicornis Candèze, 1 ♂ syntype, INDIA: Darjeeling/Dr. Pearson; M. longicornis Cand. [Candèze]; 60.70 [registration label indicating that the specimen is one of a collection acquired from the India House Museum].

Although the locality differs from the published locality 'Hindoustan', a rather imprecise term which was sometimes used for northern India and sometimes for the whole subcontinent, I believe the provenance, recorded by Candèze as 'Collection du Musée indien de Londres' is sufficient proof that the specimen is a syntype.

The species possesses the diagnostic characteristic of *Cremnostethus* Schwarz (see p. 59) in that the mucro is steeply declivous immediately posterior to the anterior coxal cavities (as Fig. 15). Apart from minor differences such as the length of the antennae (which are usually shorter in the female) and the colour of the elytra, which are dark red-brown as opposed to black (almost certainly a variable feature), the specimen bears a close resemblance to a BMNH specimen identified by Blair as *nigricollis* Schwarz (see p. 68), the type species of *Cremnostethus*.

longulus longulus (LeConte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 60 not 1962, see note p. 61).

longulus oregonensis (Leconte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 62 not 1962, see note p. 61).

{*variolatus* LeConte. Lectotype ?♀ (MCZ), designated by Fall (1934: 24) not Quate & Thompson (1967: 62 not 1962, see note p. 61). [Reduced to a subspecies of *longulus* by Van Dyke, 1932: 331. Synonymized by Quate & Thompson, 1967: 61.]

macer (LeConte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 46 not 1962, see note p. 61).

malaisei Fleutiaux (1942: 12), 1 ♂ syntype, BURMA.

Fleutiaux did not designate a type or record how many specimens he had before him at the time of the description. As it was intended that types of new species collected by the Swedish expedition to Burma and British India should be preserved in the NR, Stockholm the lectotype should be selected from the material in that collection.

The species appears to bear some resemblance to *arcanus* in that the lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75) and in the presence of a small projection on the posterior free margin of the metacoxal plate.

{*mediocris* Candèze 1897 not 1896, see references. Type material (?IRSNB).}

mendiculus Candèze, 1897 not 1896, see references. Lectotype ♂, designated by Van Zwaluwenburg (1959: 398) (IRSNB).

As the description was based on material submitted by the dealer Staudinger there may be additional paralectotypes (not cotypes) in other collections. The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

mexicanus Champion, 1896 not 1895, see references, 1 ♂, 1 ♀ syntypes.

{*morbosus* Candèze. Holotype ?sex (?IRSNB, Gaedike, 1985 does not record the species in the IP collection).}

Schwarz's figure shows that the lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75). From the description the species, which occurs in Turkestan, would appear to have at least a superficial resemblance to *arcanus* Dolin described from Tadzhikistan.

morosus Candèze. [Proposed as a replacement name for *longulus* LeConte, 1853.]

longulus LeConte, 1853: 480 (*Cratonychus*). Lectotype ♂,(MCZ), designated by Quate & Thompson (1967: 37 not 1962 see note p. 61). [Junior primary homonym of *Cratonychus longulus* LeConte, 1853: 473.]

{*simulans* Blatchley, 1927: 140. Lectotype ♂ (PU),designated by Blatchley (1930: 48).}

It is not clear from Quate & Thompson's (1967: 38) comment that '*M. simulans* is regarded as a synonym of *morosus*' whether the synonymy with *morosus*, cited without comment on pages 8 and 37 is new, based on their examination of the type material, or whether it has already been published elsewhere. Up to the present I have been unable to find an earlier citation of the synonymy.

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

mouldsi Calder, 1983: 257, 10 figs, 4 ♂ paratypes, AUSTRALIA. (015)

The aedeagus (*op. cit.* fig. 5) is distinctive in that the lateral lobes are relatively short and stout and the median lobe long (see *imitans* group p. 74).

{*niger* Fabricius, see *punctolineatus* Pelerin}

nigricollis (Schwarz, 1902(i)a, not 1901, see references p. 111). Holotype ♂ (IP, recorded by Gaedike, 1985: 50). (002)

This, the type species of *Cremnostethus*, was described from Assam. Five specimens from Sikkim, Tonglo [sic, probably an error for Tonglu, 10,074 ft, 22 m. NW. of Darjeeling on the route to Phalut (Murray, 1920: 429)], 13–16.vi.1920 (*Stevens*), identified from the description by Blair are, in my opinion, conspecific with the syntype of *longicornis* Candèze, 1860. Only examination of the type material of both species will show whether the species are conspecific. In most specimens the anterior portion of the inner border of the hypomeron is very feebly inclined meso-dorsad but in one specimen there is no perceptible inclination.

Mucro and anterior coxal cavity Fig. 15.

(*nitidus* Candèze transferred to *Priopus*, see p. 83)

noderi Fleutiaux. Type material (?MNHN). ♂ unknown.

{*obscurus* sensu Fabricius, 1775 nec Linnaeus, 1758. The type species of *Cratonychus*, see pp. 57 & 90.} (001)

ocellatopunctatus Lewis, 1894, holotype ♂.

Synonymized with *senilis* Candèze, 1885 by Ohira(1974: 357) and recalled from synonymy by Ohira & Yasuda (1984: 17 & 18).

opicus Candèze, 3 ♂ syntypes.

paganus Candèze, lectotype ♂, designated by Quate & Thompson (1967: 25 not 1960, see note p. 61), paralectotype♂. **Sp. rev.**

As far as I can discover the *communis*–

paganus synonymy, recorded without comment by Quate & Thompson (1967: 8 & 24), had not previously been published (see note p. 61). The lectotype does not run to *communis* in Quate & Thompson's key nor is it conspecific with specimens standing under this name in the BMNH collections. From the key and the description it would appear that the species bears some resemblance to *lanei* Quate, 1967.

{*palawanensis* Ohira, 1973(xii): 7, fig 4 (aedeagus), pl. 1, fig. h. PHILIPPINES. (Osaka Museum of Natural History)}

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75). Ohira (1973: 8) remarks that this species is closely allied to *ebeninus* Candèze (see p. 64).

perlongus Candèze, 1 ♀ syntype. **Sp. rev.**

The synonymy with *opicus* recorded in the Schenkling catalogue (1927: 283) appears to be based on Candèze's (1900: 94(18)) comment at the time of the description 'C'est *peut etre* (my italics) la femelle de l'espèce précédente [*opicus*]'. Differences in the profile of the mucro suggest that the synonymy is not justified. The published locality is Punjab. The syntype bears a label with 'M.P.' possibly indicating the locality Murree, Punjab from which *opicus* was also described.

The ♂ is unknown.

pertinax (Say, 1839)

For a note on the date of publication of *pertinax* see references.

As Say's type material is lost (Quate & Thompson, 1967: 50) interpretation of the species is, of necessity, subjective. The BMNH collection possesses 1 ♂, 1 ?sex., acquired from LeConte by Candèze. The specimens agree reasonably well with Quate & Thompson's (*op. cit.*) interpretation of the species.

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

phlogosus Candèze, 1 ♀ paralectotype, CHINA: [ex coll.] la Ferté-Sénectère. Lectotype ♂ (not type), PHILIPPINES, ex coll Mniszech, designated by Van Zwaluwenburg (1959: 398) (IRSNB).

Van Zwaluwenburg (*loc. cit*) remarks that the prothoracic hind angles are strongly bicarinate. As there is no trace of a second carina on the posterior angles of the pronotum of the paralectotype, there must be some doubt that it is conspecific with the lectotype.

pisciculus Candèze, 1 ♀ syntype. ♂ unknown.

planipennis Candèze, 4 ♂, 6 ?sex syntypes.

1 ♂ and 1 ?sex syntypes differ from the remainder in that the abdominal tergites are thick and dark in colour instead of thin and pale. The specimens with the thin abdominal tergites agree best with the original description in that they display more distinctly the flattening of the central portion of the elytra mentioned in the descripton.

{*porcellus* Candèze. Holotype ♂ (?MCSN, Van Zwaluwenburg (1959: 399) includes *porcellus* in the 'Key to *Melanotus* in the Genoa Museum' but it does not appear elsewhere in his work.

{*prolatus* **nom. n.**}

{*elongatus* (Schwarz, 1902(vii)). Holotype ♀ (IP, recorded by Gaedike, 1985: 32). Junior secondary homonym of *elongatus* (Hope, 1831).}

prolixus (Erichson). Holotype ♀ (?ZMHU). **Sp. rev.**

Quate & Thompson (1967: 8) record '*prolixus* (Erichson) = 1. *similis* Kirby' in their list of synonymical names in North American *Melanotus*, but the species is not mentioned under *similis* (*op. cit.*: 14) in the text, presumably because it was described from Mexico. This appears to be the first citation of the synonymy.

The BMNH possesses a male *prolixus* from Mexico determined by Candèze and 3 (2 ♂, Oxaca & Yolos, 1 ♀, Juquila) of the 5 *prolixus* specimens recorded by Champion (1896: 453). The female agrees reasonably well with Erichson's description, and, although they come from a different locality, I believe the males are conspecific. The aedeagus of each one, which has a long median lobe and short lateral lobes, is similar, but not identical, to that of *cribricollis* Candèze (= *sestrotrachelus* Hayek) figured by Quate & Thompson (1967: 78, fig. 7j). See *imitans* group p. 74.

The ♂ *prolixus* are not conspecific with the paralectotype ♂ of *similis* Kirby (see below) in which the median lobe of the aedeagus is only slightly longer than the lateral lobes (Quate & Thompson, 1967: 75 figs 4a–d). Under the circumstances I believe the restoration to specific status of *prolixus* is justified.

propexus Candèze, ?syntype ♀ determined by Candèze, ex Janson collection.

The description is based on material in the Saunders collection. Part of this collection was acquired by Janson and part by Fleutiaux (now MNHN).

puberulus (Erichson). Type material (?MNHU). (034)

The lateral lobes of the aedeagus of a specimen determined by Candèze lack apical barbs (see *annosus* group p. 75).

pulvereus Candèze (1897 not 1896, see references), lectotype ♀, designated by Van Zwaluwenburg (1959: 398), JAVA: n.sp. 93, pulvereus Cand.

Java Teykorai [Candèze yellow bordered card label, see also *immissus* p. 66]; Tsikoraí, Préangers. 2 ♀ ?paralectotypes labelled respectively 'Tengger' and 'Java' (IRSNB).

The published locality is 'monts Teikoraí, Préangers' (W. Java, see also *dispunctatus* p. 64). Mount Tengger is in eastern Java so that there is some doubt whether the specimen from that locality is part of the original type series. However, as Candèze remarks that the species is 'quelquefois teinté de rougeatre' and the elytra of both ?paralectotypes are more red-brown in colour than those of the lectotype, the specimens are provisionally accepted as having formed part of the syntype series. The specimens differ from the lectotype in that the puncturation of the pronotum is slightly finer and closer, the posterior portion of the hypomeral border is punctured and the demarcation line between it and the remainder of the hypomeron indistinct, but the decision whether the three specimens are conspecific is outside the scope of the present work.

pulverosus (Hope, 1831: 26) (*Elater*), 1 ♂ syntype, NEPAL: Nepal [yellow paper]; pulverosus Hope [?Hope]; pulverosus Hope, 4040; Hardwicke Bequest. **Comb. n.**

The number 4040 refers to volume 13 of a quarto manuscript catalogue entitled *Annotated copy of Ms. Catalogue of Coleoptera Coll.* (circa 1842) in the possession of the BMNH.

The species has not been cited in any work since the original description.

{*punctatostriatus* Schwarz, 1892(iii): 365 not 1891, see references. 3 ♂ syntypes (IP, recorded by Gaedike, 1985: 56).}

punctolineatus (Pelerin, 1829: 524), 1 ♀ syntype, GREAT BRITAIN: 2018 [print on purple paper]; cotype [printed] (Bolton Museum & Art Gallery).

[*Elater (Menalotus) niger* sensu Brullé, 1832: 136 nec [Linnaeus &] Fabricius. Synonymized by Candèze, 1860: 306.]

Pelerin based his description on two specimens (supposed ♂ & ♀) taken in meadows near Twickenham, Surrey in June 1827. Mr P. L. Bloomfield (pers. comm., iii.1973) informed me that the Bolton Museum records show that the above specimen is one of the two collected by Pelerin. The second specimen was acquired by E. W. Janson (Janson, 1855: 223) whose collection was presented to the BMNH in 1903 by F. C. Godman (Waterhouse, 1906: 590). Up to the present I have been unable to locate the specimen.

This is the species recorded as *niger* Fabricius, 1792 in the Schenkling catalogue (1927: 277). Fabricius did not describe the species but listed references to *Elater niger* Linnaeus, 1761 and 1767. In a subsequent work (1801: 227 no. 35) Fabricius lists the same references under *niger*. As far as I can ascertain there is no reason to believe that Fabricius intended to erect a new species.

The belief that *niger* Fabricius differs from *niger* Linnaeus can be traced back to a work by Brullé and its interpretation by Kiesenwetter. Brullé (1832: 136) recorded '*Elater* (*Menalotus* [corrected to *Melanotus*, *op. cit.*: [401]] Esch. ined. *niger* Fabr. [1801] Syst. Eleuth. II p. 227 no. 35' (see NOTE p. 71) with a comment which indicates that the Greek species before him had serrate claws. I do not think that Brullé intended to indicate that *niger* Fabricius differed from that of Linnaeus. My belief is based on an examination of Brullé's work which shows that he only rarely refers to Linnaeus and that his chief works of reference were the publications of Fabricius, especially the *Systema Eleutheratorum* (1801), and Dejean. Kiesenwetter (1858: 249 & 311), however, seems to have come to the conclusion that *niger* Linnaeus and *niger* Fabricius (or more probably Brullé's interpretation of *niger* Linnaeus **and** Fabricius) are not conspecific and transferred *niger* Linnaeus to *Athous*, where it has remained to the present day, and included *niger* Fabricius in *Melanotus*. He added that as the two species belonged to different genera there was no need to make any changes in the nomenclature. Subsequent authors employed *niger* Fabricius, 1792 for a relatively common European *Melanotus* species. Candèze (1860: 306) synonymized *Elater punctolineatus*, which he credited to Curtis although Curtis (1854: 13) attributed the species to Pelerin, with *Melanotus niger* Fabricius (1801). Harold (1869(b): 91) pointed out that *punctolineatus* Pelerin is the correct name for the species commonly known as *niger* Fabricius and Harold (1869(a): 1850) lists *punctolineatus* Pelerin with *niger* Fabricius as a synonym and Candèze, (1891(v): 140) followed suit. Nevertheless the following year Kiesenwetter (1870: 34) again stated that in his opinion the change of name was unnecessary. It would appear that there is still no consensus of opinion, as at the present time some authors (e.g. Leseigneur, 1972: 165,) employ *niger* Fabricius with *punctolineatus* as a synonym and others use *punctolineatus* either with (e.g. Binaghi, 1939; 272) or without (Dolin, 1960: 1036) listing *niger* as a synonym. In a recent work Lohse (1979: 139) uses *niger* followed by *punctolineatus* in parentheses. In my opinion

there is no doubt that, assuming the synonymy is justified, *punctolineatus* Pelerin is the valid name. Brullé's material is believed to be in the MNHN but I have been unable to locate it.

NOTE. The matter is further complicated by the fact that on both occasions Fabricius (1792: 221; 1801: 227) records the reference to *niger* Linnaeus, 1767 as 'syst. Nat. 2. 656. 36.' No. 36 is *Elater tetrastichon*, a name which does not appear in the Schenkling catalogue, *niger* is no. 33. I am convinced that this is an error, one of the many of this kind to be found in Fabricius' work. For example, in his 1801 work his first reference to *niger* (*op. cit.*: 227 no. 35) 'Linn. syst. Nat. 2. 221. 25' is in fact a reference to his own work of 1792.

The identity of *tetrastichon* is yet another Elaterid problem requiring investigaton.

punctosus (Walker, 1858: 280) (*Athous*), 2 ♀ syntypes, SRI LANKA. **Comb. n.**

The appearance of the aedeagus of a male from Sri Lanka, which is believed to be conspecific with the syntypes, bears a very close resemblance to that of specimens standing in collections as *hirticornis* (Herbst, 1806). Further studies may show that the species are conspecific.

{*recessus* Candèze (1897 not 1896, see references). Lectotype ♂, designated by Van Zwaluwenburg (1959: 399), 2 ?sex paralectotypes (IRSNB).}

As the material on which the description is based was submitted by the dealer Staudinger there may be additional paralectotypes in other collections.

regalis Candèze, 1 ?syntype: Melanotus regalis Cdz Chine [Candèze].

The published locality is 'Chine, Shanghai'. It is not certain that this specimen is a syntype as the species does not figure in either Janson's or Waterhouse's lists of Candéze specimens acquired by Janson (see p. 54). Candèze' original material may be in the IRSNB, Brussels. In the Schenkling (1927) catalogue *regalis* is listed under both *Spheniscosomus* (p. 269) and *Melanotus* (p. 279). As the species figures among the Indomalayan *Melanotus* species on page 283 with the comment 'Siehe paläarktische Arten!' it would appear that the entry under *Spheniscosomus* is erroneous.

restrictus Candèze, 1 ♂ syntype. (036)

robustus (Erichson). Holotype ?♀ (?MNHU).

Reduced to a variety of *fusciceps* by Schwarz (1892(viii): 163) and restored to specific status by Binaghi (1939(xii): 175).

({*robustus* (Szombathy, 1910(vii)). Type material (?TM). Junior secondary homonym of *robustus* (Erichson, 1841), see *fortis* **nom. n.**})

rodriguezi Candèze. Type material (?IRSNB).

The median lobe of the aedeagus projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group p. 74). The projecting portion of the median lobe has a distinctive elongate lozenge shape.

rubicundus Candèze. Type material (?IRSNB).

The median lobe of the aedeagus resembles that of *sestrotrachelus* in that it projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group p. 74)

ruficaudis Candèze. Lectotype ♀, designated by Van Zwaluwenburg (1959: 399), 2 ♀ paralectotypes (MCSN), 1 ♂ and probably additional paralectotypes (IRSNB).

The lateral lobes of the aedeagus each has a very long apical barb. The general appearance of the aedeagus, which is figured by Van Zwaluwenburg (1959: 414, pl. 2, fig. 27), bears some resemblance to that of *hamatus* figured by Quate & Thompson (1967: 78, fig. 7d).

rufinus Candèze, 1 ♂ syntype.

({*rufipes* Herbst, 1784 (*Elater*). Type material (?MNHU). Junior primary homonym of *Elater rufipes* De Geer, 1774 [= *Prosternon tessellatum* (Linnaeus, 1758), see Hayek, 1979: 185].}

According to Leraut (1981: 98) the valid name for *rufipes* Herbst nec De Geer is *M. villosus* (Geoffroy *in* Foucroy, 1785), q.v. p. 74.

Erichson (1841: 96) synonymized *fulvipes* Herbst, 1806, the type species of *Melanotus*, with *rufipes* Herbst, 1784 and this synonymy has been accepted by subsequent cataloguers and other workers. See also *fulvipes* Erichson p. 65.

{*rugosiventris* Fleutiaux, 1933: 220. Type material (?MNHN).}

The second type locality, Monts Mauson, 2 à 3000 m, avril-mai (*Fruhstorfer*) is probably an error for Monts Manson, see *Priopus mirabilis* p. 82.

rugulipennis Champion, 1896 not 1895, see references, holotype ♂.

rusticus (Erichson). Type material (?MNHU).

The aedeagus is figured by Schwarz (1892: pl. 2, fig. 5). The lateral lobes are furnished with apical barbs.

sagittarius (LeConte). Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 41 not 1962, see note p. 61).

seniculus Candèze, 3 ♂ syntypes.

None of the specimens bears a locality label (see *erythropygus* above). One specimen was obtained directly from Lewis and bears his determination label, the other two, of which one bears Candèze' determination label, were

acquired with the Janson collection. The BMNH collection also possesses a specimen from the Lewis collection labelled 'var. a'.

senilis Candèze. Type material ((ZMU, not confirmed).

sestrotrachelus **nom. n.**

cribricollis Candèze 1860, lectotype (not holotype) ♀, designated by Quate & Thompson (1967: 68). Junior secondary homonym of *cribricollis* (Faldermann, 1835).

The median lobe of the aedeagus projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group p. 74).

similis (Kirby), lectotype ♀, designated by Quate and Thompson (1967: 15 not 1960, see note p. 61), paralectotype ♂. (016)

For comments concerning the data labels see below.

{*laticollis* Erichson, 1841. Lectotype ♂ (MNHU), designated by Quate & Thompson (1967: 14) not Quate (1960), see note p. 61. [Synonymized with *fissilis* Say by LeConte, 1853: 477.]}

{*sphenoidalis* Melsheimer, 1845 (not 1846, see references). Lectotype ♂ (not type) (MCZ), designated by Quate & Thompson, 1967: 15. [Synonymized with *fissilis* Say by LeConte, 1853: 477.]}

{*ochraceipennis* Melsheimer, 1845 (not 1846, see references). Lectotype ♀ (MCZ), designated by Quate & Thompson (1967: 15) not Quate (1962), see note p. 61. [Synonymized with *fissilis* Say by LeConte, 1853: 477.]}

{*exuberans* Leconte, 1853. Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 15) not Quate (1962), see note p. 61. [Synonymized with *similis* Kirby by Quate & Thompson, 1967: 15.]}

{*fissilis* Say, 1839. [Synonymized by Quate & Thompson, 1967: 14.]}

For a note on the date of publication of *fissilis* see references.

Quate & Thompson's lectotype data citation for *similis* is erroneous. The specimen (with female genitalia attached) bearing Quate's lectotype label (dated 1960) bears a small round label with 'N. Amer.' on one side and '5855a' on the reverse. The number refers to entry 5855 [two specimens, a & b) in volume 18 of a quarto manuscript catalogue entitled *Annotated Ms. Catalogue of Coleoptera Coll.* (circa 1842) in the possession of the BMNH. Kirby's ms. determination label '(195) 3. similis' is pasted into this catalogue. A second, ♂, specimen labelled 'paratype' by Quate also carries a round label with 'N. Amer.' on one side and '5855b' on the other. Neither specimen bears the 'Amer. Bor., ex Mus Murray or Frey (presumably an error for Fry) coll. 1905.100' labels recorded by Quate & Thompson. These labels are attached to two males which also bear yellow BMNH paratype labels which were probably attached in error in the course of curatorial work many years ago. One carries in addition a determination label (almost certainly Fry's) with the name *brevicollis* Hbst. There is no evidence that either of these specimens formed part of Kirby's original series.

According to Quate & Thompson (1967: 15) the 'types' (sic) of *fissilis* Say are lost. It follows that any interpretation of the species is subjective. The BMNH collection possesses several specimens determined by Candèze. All are conspecific with *similis* Kirby.

Quate & Thompson (1967: 8) list *prolixus* (Erichson) as a synonym of *similis* (see above). The specimens of *prolixus* known to me (see p. 69 above) are not conspecific with *similis* Kirby.

sobrinus Ménétries. Type material (?ZI).

menetriesii Faldermann. Type material (?ZI).

The fact that Faldermann records *sobrinus* Ménétries as a synonym of *menetriesii*, which he credits to Dejean, suggests he believed Dejean's name took precedence over Ménétries'. If, as seems probable, Ménétries and Faldermann based their studies on the same material (collected by Faldermann & Szolvitz between 1827 and 1831) the two species may be objective synonyms.

Interpretation of the species is based on a male from the Dejean collection with Dejean's determination label 'Cratonychus menetriesii mihi. sobrinus Ménétries, h. in Russia merid. D. Ménétries'.

{*spadix* (Erichson, 1841 not 1842, see references). Lectotype ♂ not holotype (MNHU), designated by Quate & Thompson (1967:19). [Extracted from synonymy with *communis* by Quate & Thompson, 1967: 18.]}

Candèze (1860: 354, *passim*) remarked that he had not seen the type of *spadix* but that a specimen sent to him with that name by Schaum appeared not to differ significantly from *communis*. Candèze seems to have regarded the synonymy as tentative as he did not include *spadix* in the list of species synonymous with *communis*. However, 30 years later in his catalogue (1891: 145) he lists *spadix* as a synonym of *communis* and subsequent cataloguers have done the same. Quate and Thompson did not indicate that they were restoring *spadix* to specific status.

spernendus Candèze, 1 ♂, 5 ?sex syntypes.

staudingeri (Candèze) (*Dodecactenus*). Syntype material (?IRSNB and probably other collections as Candèze acquired the species from the dealer Staudinger). **Comb. n.** (003)

The fact that the published locality 'Veragua; Chiriqui' appears to refer to two separate provinces in Panama suggests that the description was based on at least two specimens.

The median lobe of the aedeagus of a ♂ identified by Champion resembles that of *sestrotrachelus* in that it projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group p. 74)

Anterior aspect of head Fig. 5.

{*striatus* Guimarães, 1933: 2 0. BRAZIL: Bahia, Entre Rios. (Location of type material unknown).}

sulcatus Candèze, 1 ♀ syntype, INDIA: Darjeeling/ Dr Pearson; M. sulcatus Cand. [Candèze].

Although the locality differs from the published locality 'Hindoustan', a rather imprecise term which was sometimes used for northern India and sometimes for the whole subcontinent, I have no doubt that the specimen is a syntype.

The specimen lacks a museum registration label but as the locality label is identical to that on the syntype of *longicornis* recorded above I believe it was also acquired from the India House Museum.

sulcicollis (Mulsant & Guillebeau, 1855). Syntype material, Wachanru, Doublier & Joubert collections (location unknown, perhaps Museum of Natural History, Lyon, France.)

cuneiformis Baudi, 1871. 8 syntypes (?MIZSU). [Reduced to a variety of *sulcicollis* by du Buysson, 1894: 130.] (028)

The character states of *cuneiformis*, the type species of *Spheniscosomus*, for the DELTA-format file, 028 p. 97, were drawn from specimens from the type locality, Cyprus. The type of another Baudi species, *Adelocera pygmaeus*, is known to be in the MIZSU, Turin (Hayek, 1973: 45)

Whether the synonymy of these two species, one from the 'Midi de la France' and the other from Cyprus, is justified requires confirmation.

tamsuyensis Bates, 1 ♂ syntype.

A serious pest of sugar-cane in Taiwan (Miwa & Yanagihara, 1929: 288).

taenicollis (LeConte). Holotype ♂ (MCZ) not lectotype. As Quate & Thompson (1967: 68) quite rightly remark, the original description was based on a single specimen.

Despite the fact that in their description Quate & Thompson (1967: 67) remark that the mandibles are without a pit they include (*op. cit.*: 7) the species in the *americanus* group whose distinguishing feature is that a pit is visible on the mandible. A specimen in the BMNH determined by Candèze lacks a pit on the mandible.

telum Candèze. Type material (Fleutiaux collection, now in MNHN).

tenax (Say, 1839)

For a note on the date of publication see references.

As the type material is lost (Quate & Thompson, 1967: 49) any interpretation of the species is necessarily subjective. Candèze (1960: 360) lists *Cratonychus gregarius* Dej. [ms. species] as a synonym of *tenax*. Interpretation of this species is based on 1 ♀ labelled '*gregarius*' by Dejean and 1 ♂ determined by Candèze.

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

tenebrosus (Erichson). Type material (?MNHU).

It is not clear whether Erichson based his description on material in his own collection or in that of Schüppel, the location of which is unknown.

{*testaceus* (Melsheimer, 1845 not 1846, see references)}

This species was synonymized with *angustatus* Erichson by LeConte (1853: 474) and restored to specific status by Quate & Thompson (1967: 46). As it is impossible to tell from Melsheimer's description how many specimens he had before him at the time of the description the specimen (MCZ) which Quate & Thompson (1967: 47) suspect to be the type may be a syntype.

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

{*trapezicollis* Candèze, 1897 not 1896, see references. Type material (?IRSNB).}

trapezoideus (LeConte). Lectotype ♂ (MCZ), designated by Quate and Thompson (1967: 48 not 1962, see note p. 61).

The lateral lobes of the aedeagus lack apical barbs (see *annosus* group p. 75).

tropicalis (Champion, 1896 not 1895, see references), 12 ♂, 7 ♀ syntypes.

The median lobe of the aedeagus resembles that of *sestrotrachelus* in that it projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (see *imitans* group p. 74)

(*umber* Bates, transferred to *Penthelater* see p. 89.)

umbilicatus (Gyllenhal). Type material (?NR, ?ZUM). (040)

This African species is distinctive in that the anterior portion of the scutellum is gradually declivous to the prescutum (#9,4).

vafer (Erichson). Type material (?ZMHU).

{*validus* Schwarz, 1892(iii): 366 not 1891, see references. 3 ♂ syntypes (IP, recorded by Gaedike, 1985: 70).}

{*variolatus* LeConte, see *longulus oregonensis* (LeConte) above.}

venalis Candèze, 1 ♂ syntype.

Schwarz' (1892(viii): pl. 2, fig. 31) figure of the aedeagus is misleading. The lateral lobes of the aedeagus terminate in well-developed barbs.

ventralis Candèze, 1 ♀ syntype.

verberans (LeConte). Lectotype ♂ (MCZ), designated by Quate & Thompson (1967: 29 not 1962, see note p. 61).

vermiculatus Candèze. Not included in the Waterhouse or Janson lists (see p. 54). Type material (?IRSNB).

villosus (Geoffroy *in* Fourcroy, 1785). Lectotype ?sex (MNHN),designated by Leraut (1981: 97).

This is the valid name for the species until now known as *rufipes* Herbst, 1784, a junior primary homonym of *rufipes* De Geer, 1774 (= *Prosternon tesselatum*(Linnaeus, 1758, see Hayek, 1979: 185) and senior synonym of *fulvipes* Herbst, 1806, type species of *Melanotus*. For details of the synonymy see Leraut (1981: 97–98).

Lateral and anterior aspect of head Figs 1, 3; dorsal and ventral aspect of posterior angles of pronotum Figs 10, 10a; mucro and anterior coxal cavity Fig. 13; ventral aspect of left hand side of prothorax Fig. 18a; mesocoxa and mesocoxal cavity Fig. 23; last visible abdominal sternite Fig. 27; posterior coxal plate Fig. 32; front leg Fig. 38.

Two species groups based on the appearance of the aedeagus

The following two groups are based on the appearance of the aedeagus. In one the lateral lobes lack apical barbs and in the other the median lobe of the aedeagus projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes. In *imitans* and *mouldsi* the lateral lobes are much shorter compared to the basal piece than is the case in the majority of species.

One species (*carinatus*) possesses the attributes of both groups in that the median lobe is long and the short lateral lobes lack apical barbs.

The groups are purely practical and intended as an aid to identification. I do not believe that they reflect a natural division of the genus. The names of the groups are of no significance; they were originally used because published figures of the aedeagus of the species in question are available.

The references are to figures of the aedeagus where these do not appear in the original publication.

Melanotus imitans group

In the following species the median lobe of the aedeagus projects beyond the lateral lobes by a distance considerably greater than the length of the apical barbs of the lateral lobes (#24,1) or where barbs are absent the length of the median-lobe projecting beyond the tips of the lateral lobes is equal to or greater than one-third of the total length of the aedeagus.

carinatus Candèze — Sumatra
Van Zwaluwenburg, 1959: pl. 2, fig. 21. The lateral lobes lack apical barbs.

chiricahue Knull — U.S.A.
The aedeagus figured by Quate & Thompson (1967: 78, fig. 7i) differs slightly from that published by Knull (1962). Further investigations are necessary to discover whether the two publications refer to the same species.

(*cribricollis* Candèze)
see *sestrotrachelus* below

guatemalensis (Champion) — C. America
The aedeagus bears some resemblance to that of *sestrotrachelus*.

imitans Van Zwaluwenburg — Papua New Guinea
Calder, 1967: 259: fig. 8.

lanuginosus (Champion) — Mexico
The aedeagus bears some resemblance to that of *sestrotrachelus*.

mouldsi Calder — Australia

prolixus Erichson — Mexico
The aedeagus bears some resemblance to that of *sestrotrachelus*.

rodriguezi Candèze — C. America
The mid lobe has a distinctive elongate lozenge shape.

rubicundus Candèze, ♂ determined by Champion The aedeagus bears some resemblance to that of *sestrotrachelus*. — Guatemala
sestrotrachelus Hayek (see p. 72) Quate & Thompson, 1967: 78, 7j (as *cribricollis*) — U.S.A.
staudingeri (Candèze), ♂ determined by Champion The aedeagus bears some resemblance to that of *sestrotrachelus*. — C. America
tropicalis (Champion) The aedeagus bears some resemblance to that of *sestrotrachelus*. — C. America

Melanotus annosus group

In the following species the lateral lobes lack apical barbs (#23,3).

The male external genitalia of the American species are figured by Quate & Thompson, 1967: figs 5f–m, 6a–d and 6j–m.

americanus Herbst — U.S.A.
annosus Candèze Schwarz, 1892(viii): pl.2, fig. 21. — Japan
arcanus Dolin, 1979: 72, fig. — U.S.S.R.
beameri Quate — U.S.A.
candezei Schwarz — Java
carinatus Candèze Van Zwaluwenburg, 1959: pl. 2, fig. 21. The length of the median lobe projecting beyond the tips of the lateral lobes is more than one-third of the total length of the aedeagus. — Sumatra
cladestinus Erichson — U.S.A.
cribriventris Blatchley — U.S.A.
cribulosus LeConte — U.S.A.
depressus Melsheimer — U.S.A.
dispunctatus Candèze — Java
hyslopi Van Zwaluwenburg — U.S.A.
ignobilis Melsheimer — U.S.A.
malaisei Fleutiaux — Burma
mediculus Candèze Van Zwaluwenburg, 1959: pl. 2, fig. 25. — Borneo
morbosus Candèze Schwarz, 1982(viii): pl. 2, fig. 22. — Turkistan
morosus Candèze — U.S.A.
palawanensis Ohira — Philippine Is.
pertinax Say — U.S.A.
piceatus Blatchley — U.S.A.
praesinus Blatchley — U.S.A.
puberulus Erichson — Java
tenax Say — U.S.A.
testaceus Melsheimer — U.S.A.
trapezoideus LeConte — U.S.A.

METRIAULACUS Schwarz

Metriaulacus Schwarz, 1902(i)a: 198. Type species: *Metriaulacus nigrolaterus* Schwarz, by monotypy.

GENERIC DIAGNOSIS. Pronotum with basal lateral incisions (#7,1 as Fig. 10). In ventral view posterior angles of prothorax truncate at apex (#26,2 as Fig. 10a). Inner margin of hypomeron with a well-defined narrow, completely, or almost completely, impunctate border separated from rest of hypomeron by a distinct groove or raised above it (#10,1). Inner border of hypomeron extends beyond anterior divergence point of hypomeron and prosternum, forming anterior free border of hypomeron which slopes meso-dorsad and is concave (#29,1). Pronotosternal suture situated at or near base of an impunctate groove which attains or almost attains anterior margin of anterior coxal cavity; sides of groove are formed by a steeply declivous concave portion of the inner border of hypomeron and impunctate lateral margin of the prosternum (#27,1, Fig. 19). Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2 as Fig. 27). Third tarsal segment simple, vertically or obliquely truncate distally; if a small ventral prolongation or lobe is present it does not extend beneath entire length of 4th segment (#19,2).

If this diagnosis is compared with those of *Melanotus* (p. 56) and *Psellis* (p. 77) it will be seen that #28 is missing. This is because #28 is dependent on #27 as follows: if #27,1, #28 is impossible, see p. 95.

OTHER CHARACTERS COMMON TO THE SPECIES EXAMINED. The four species examined bear a strong resemblance to one another and the description of the fifth suggests that its general appearance does not differ very much from the others. They resemble *Melanotus* in that the mesepisternum does not form part of the margin of the mesocoxal cavity which is made up of the mesosternum, mesepimeron and metasternum (#13,1 as Fig. 23) but, unlike *Melanotus*, the length of the junction between the mesosternum

and mesepimeron, which is relatively long, does not differ significantly from one species to another. In addition the four species examined, and probably also *formosanus*, display the following character states: 2nd and 3rd antennal segments equal or subequal in length (#1,1), flat faces of antennal segments without longitudinal carinae (#2,2), frons inclined to a greater or lesser degree (#3,2), nasale simple or with a raised median area (#30,1 or 2), never with a vertical carina or two confluent carinae forming an inverted 'Y', parantennal and mandibular pits absent (#4,1 & 5,2), lateral margins of prothorax each with a carina extending from posterior to anterior angle (#6,1), apex of each elytron simple (#11,1), ventral face of mucro horizontal in anterior half of its length (#14,1), mesosternal groove feebly angled (#15,3), suture between mesosternum and metasternum distinct (#16,2), posterior margin of metacoxal plate lacks a distinct tooth (#17,2), femora not distinctly compressed (#18,2), apex of last visible abdominal sternite bluntly arcuate (#20,3 as Fig. 27), abdominal tergites thin, not strongly sclerotized (#22,2), lateral lobes of aedeagus each terminates in a barb (#23,1) and median lobe only slightly longer than lateral lobes (#24,2).

COMMENTS. Only one character state (#27,1, pronotosternal suture situated at the base of an impunctate groove) distinguishes *Metriaulacus* from *Melanotus*. However, the character is so well defined that, though there is a very small degree of inter-specific variation in the length and depth of the groove, there is no difficulty in distinguishing *Metriaulacus* species from those *Melanotus* species (e.g. *hapatesus*, *hirtellus*) in which the inner border of the hypomeron slopes mesodorsad for the anterior two-thirds of the length of of the suture (and even further in some individuals). Two species (*gobius* & *formosanus*) differ from most *Melanotus* species (see p. 56) in that the posterior angles of the pronotum are distinctly bicarinate (#8,2); in the three other species the posterior angles are unicarinate (#8,1). The valves of the ovipositor of *veles* are delicate while those of *gobius* are slightly more strongly sclerotized. As there is so little material available for study it is not possible to make any useful comments on the range of variation of the other character states. It seems probable that the characters will be found to vary in much the same way as in *Melanotus*.

THE HISTORY OF THE GENUS. Schwarz erected the genus for a species which differed from all known melanotine beetles in that 'die Prosternalnäte, die wie bei *Adelocera* [sensu auctorum, nec Latreille = *Lacon* Castelnau see Hayek, 1973: 52] der ganzen Länge nach bis zu den Vorderhüften hinab tief ausgehölt sind' (pronotosternal sutures deeply excavate throughout their entire length as in *Adelocera*). This description is misleading. The suture itself is not excavate but lies at or near the base of an impunctate groove formed in almost equal parts by the steeply declivous portion of the inner border of the hypomeron and the lateral margin of the prosternum. The grooves of the two genera differ in structure in that in *Lacon* the groove is formed by a laterally directed invagination of the inner margin of the hypomeron whereas in *Metricaulacus* the groove is directed dorsad and formed in almost equal parts by the impunctate border of the hypomeron and the impunctate lateral margin of the prosternum.

SEXUAL DIMORPHISM. Too little material in good condition is available to make any useful comment. It seems probable that the sexes differ in size and the length of the antennae as in *Melanotus*.

DISTRIBUTION. Western Indomalayan region.

BIOLOGY AND HABITS. Unknown.

Species included in the genus

The following five species are at present assigned to the genus.

badiipennis (Candèze). Syntype material 1 ex., 'Indes Orientales' (?IRSNB). [Described as *Melanotus,* the species was transferred to *Metriaulacus* by Miwa, 1930: 65.]

The imprecise published locality includes eastern India, Burma, Thailand, Indochina, Malaya and Indonesia (see Hayek, 1973: 271).

As the BMNH collections do not contain any specimens bearing a Candèze determination label or with some other good claim to syntype status, and the species does not figure in either Waterhouse's or Janson's manuscript lists of Candèze species in the Janson collection (see p. 54), the material should be in the IRSNB, Brussels (see p. 54, note 7).

Interpretation of the species is based on 2 ♂ 'India' & 'Ind. or. and 1♀ 'E. Ind.' in the BMNH which agree well with the description. Miwa (1930: 65) records the species from N. India and Formosa. No other records are known to me. Candéze remarked that the species is remarkable for the deep pronotosternal sutures.

{*formosanus* Miwa, 1927: 113, fig. 10. 2 syntypes, 1 ♂, 1 ♀, TAIWAN: Baibara [geographical position unknown], 15.viii. 1925 (*Kikuchi*). (?ARI, see p. 106).}

The species resembles *gobius* in that the posterior angles of the pronotum are bicarinate.

gobius (Candèze), lectotype ♀ (not type), designated by Van Zwaluwenburg (1959: 300). [Described as *Melanotus* and transferred to *Spheniscosomus* by Candèze, 1900: 34 (*passim*) and to *Metriaulacus* by Fleutiaux, 1933: 214.] (018)

Fleutiaux (*loc. cit.*) records this species, which was described from Java, from North Vietnam and Burma.

nigrolaterus Schwarz, 1902(i)a: 198. 1 syntype (IP, recorded by Gaedike, 1985: 51). (017)

Interpretation of the species is based on a specimen from Borneo in the BMNH which agrees well with the description except that the combined length of the 2nd and 3rd antennal segments does not exceed that of the 4th segment.

Ventral aspect of left hand side of prothorax Fig.19.

veles (Candèze), lectotype ♂ (not type), designated by Van Zwaluwenburg (1959: 400). [Described as *Melanotus*, transferred to *Spheniscosomus* by Candèze, 1900: 94 (*passim*) and *Metricaulacus* by Fleutiaux, 1933: 214.]

Fleutiaux (*loc. cit.*) records the species which was described from Java, Burma, Laos and the Philippines.

PSELLIS Candèze

Psellis Candeze, 1860: 289. Type species: *Cratonychus promiscuus* Erichson, by monotypy.

GENERIC DIAGNOSIS. Pronotum with basal lateral incisions (#7,1, as Fig. 10). In ventral view posterior angles of prothorax truncate at apex (#26,2, as Fig. 10a). Inner margin of hypomeron with a well-defined narrow, completely, or almost completely, impunctate border separated from rest of hypomeron by a distinct groove or raised above it (#10,1, as Figs 18, 18a). Inner border of hypomeron extends beyond anterior divergence point of hypomeron and prosternum, forming anterior free border of hypomeron which slopes meso-dorsad and may be concave (#29,1, as Figs 18, 18a). Pronotosternal suture not situated at base of a groove (#27,2), but inner border of hypomeron slopes meso-dorsad within anterior two-thirds of its length to form a shallow channel or groove (#28,1); inner wall of groove, formed by lateral margin of prosternum, punctured. Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2, as Fig. 27). Third tarsal segment dorsoventrally depressed, ventral prolongation does not extend beneath entire length of 4th segment (#19,3, Figs 40, 41).

COMMENT. Only one generic taxonomic character, the structure of the third tarsal segment (#19,2), distinguishes *Psellis* from *Melanotus*.

The character states of the only known species (026 *promiscua*) will be found on p. 97.

THE HISTORY OF THE GENUS. The genus was erected for a single species from Mauritius with the same characters as *Melanotus* except that the 3rd tarsal segment is dilated (i.e.dorsoventrally depressed) and the 4th very small. Fifty years later Szombathy (1910(xii)) described a second species (*formosana*) from Taiwan but examination of the type material has shown that it differs from the type species in structure of the 3rd tarsal segment which is not dorso-ventrally depressed but obliquely truncate distally and in the absence of basal lateral incisions on the prothorax. On the basis of other characters (structure of the frons, scutellum and last visible abdominal sternite) Platia (1986) established *Szombatia* (see p. 85) to accommodate *formosanus*.

DISTRIBUTION. Mauritius and Réunion.

BIOLOGY AND HABITS. Vinson (1960: 152) remarks that in Mauritius the species is occasionally beaten from various indigenous shrubs. The larva is unknown.

Species included in the genus

The genus includes a single species.

promiscua (Erichson). Type material (?MNHU). (026)

madagascariensis Candéze. Type material, REUNION [not Madagascar, according to Fleutiaux, 1932: 37] (MNHN). [Synonymized by Fleutiaux, 1932: 37.]

Interpretaion of the species is based on four specimens from Mauritius in the BMNH, 1 ♂ identified as *promiscua* by Candèze, 2 ♂, 'Mt. Pouce, i.1933 & xii.1940' and 1 ♀ 'Mt. Corps du Garde, i.1934' (localities recorded by Vinson, 1960: 152) identified by Fleutiaux.

Dorsal and lateral aspect of tarsi Figs 40, 41.

PRIOPUS Castelnau

Priopus Castelnau, 1840: 251. Type species: *Priopus frontalis* Castelnau, by subsequent designation (Hyslop, 1921: 666).

Diploconus Candèze, 1860(vii): 290. Type species: *Diploconus peregrinus* Candèze, by subsequent

designation (Hyslop, 1921: 640). [Unrecognised senior homonym of *Diploconus* Haekel, 1861 (Radiolaria). See below.] Implicit subjective synonymy with *Priopus* here confirmed (see p. 79).

Thaumastiellus Schwarz, 1902(i)b: 336. Type species: *Thaumastiellus bioculatus* Schwarz, by monotypy. **Syn. n.**

Neodiploconus Hyslop, 1921: 658. [Unnecessary replacement name for *Diploconus* Candèze.]

Pulchronotus Fleutiaux, 1933: 206 [as a subgenus of *Thaumastiellus*.] Type species: *Diploconus ornatus* Candèze, by original designation. **Syn. n.**

Ploconides Fleutiaux, 1933: 208 [as a subgenus of *Neodiploconus*.] Type species: *Diploconus spiloderus* Candèze, by original designation. **Syn. n.**

GENERIC DIAGNOSIS. Pronotum without basal lateral incisions (#7,2, Fig. 11). In ventral view posterior angles of prothorax terminate in a point (#26,1, Fig. 11a) [one known exception, *N. boninensis*, p. 80]. Inner margin of hypomeron without a well-defined narrow impunctate border; if portion of hypomeron adjacent to pronotosternal suture is impunctate the impunctate area is not separated from rest of hypomeron by a distinct groove or raised above it (#10,2, Figs. 20, 21). Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2, as Fig. 27). Third tarsal segment simple, vertically or obliquely truncate distally; if a small ventral prolongation or lobe is present it does not extend beneath entire length of 4th segment (#19,2, as Figs 38, 39).

OTHER CHARACTER STATES COMMON TO THE SPECIES EXAMINED. 2nd and 3rd antennal segments equal or subequal in length (#1,1), parantennal and mandibular pits absent (#4,2, 5,1), anterior margin of scutellum straight or slightly arcuate (#9,3), suture between mesosternum and metasternum always distinct (#16,2) and often lies at the base of a groove, ventral face of mucro either horizontal or else slightly inclined posteriad (#14,1 or 2); no species are known in which the mucro is steeply inclined or angled; in profile, margin of mesosternal groove either slopes anteriad or is feebly angled (#15,1 or 3). Up to the present no species has been found in which the mesosternal groove is distinctly angled. Femora not distinctly compressed (#18,2) and lateral lobes of aedeagus are barbed at apex (#23,1).

COMMENTS. All states of characters 2, 3, 6, 8, 11, 17, 22, 24, 30 and 31 are known to occur in the species now assigned to *Priopus*. In ventral view the posterior angles of the pronotum of all the specimens examined, with one exception (038, *boninensis*), terminate in a point; in a few species (e.g. *niger*) the posterior angles, when viewed from below, have the appearance of being obliquely truncate (Fig. 12) in that there is a small projection on the inner margin of the the hind angle. The size of the projection appears to vary both inter- and intraspecifically but its presence or absence may prove to be of some value at specific rank. Interpretation of the structure of the margin of the mesocoxal cavities (#13) presents considerable difficulties. In the majority of species, although the length of the junction between the mesosternum and mesepimeron is short (Fig. 25), there is no doubt that the mesepisternum does not form part of the margin of the cavity. However, in a few species (e.g. 025 *frontalis*, 027 *ornatus* and 041 *nigerrimus*) it is often extremely difficult, if not impossible, to decide whether the mesepisternum forms part of the margin of the mesocoxal cavity; sometimes the structure of the left and right cavities appear to be asymmetrical. Further investigations are required to discover the degree to which the sclerites move in relation to one another when the beetles are active. *N. homostictus* (022) is the only species known to me in which the mesepisternum clearly forms part of the margin of the mesocoxal cavity (Fig. 26). With one exception, in which there is a small pointed projection on either side near the apex of the last visible abdominal sternite (#20,1, Fig. 30, 021 *ciprinus*), the apical margin of the last visible abdominal sternite of the species examined is bluntly arcuate (as Fig. 27). The length of the median lobe of the aedeagus (#24) varies from one species to another (well illustrated in Van Zwaluwenburg, 1959: 414, pl. 2, figs 17–20) but up till now no species with a conspicuously long median lobe (e.g. similar to that of *M. carinatus* (*op. cit.* fig. 21) has been found. The width of the median lobe seems to be more variable than in *Melanotus* (*op. cit.* figs 17–20).

THE HISTORY OF THE GENUS. Castelnau erected *Priopus* for a new species, *frontalis*, from Java and four species known to him as *fuscus* F. [= *fuscus* sensu auctorum., see *M. hirticornis* p. 66], *niger* F. [= *niger* sensu Brullé, see *M. punctolineatus* Pelerin p. 70], *obscurus* F. [see *species incertae sedis* p. 90], and *brunnipes* Germar [*Melanotus* see p. 61]. Castelnau states that the essential difference between *Priopus* and *Elater* lies in the pectinate claws of the former and he remarks that all the species he has seen belong to *Melanotus* Eschscholtz, [1829] to which he [now] unites *Aptopus* and *Perothops*. In the heading he also

includes '*Perimecus* Dillwyn, Steph.' as a synonym. He did not explain why he did not use Eschscholtz' name but the reason is not difficult to find. Earlier in the same volume (1840: 99) he had adopted Dejean's (1831: 698–701) use of *Melanotus* for two South American Carabids. Why he did not follow Boisduval & Lacordaire's (1835: 631) use of *Cratonychus* Dejean is unknown. It may be that he considered that the synonymy of *Aptopus*, *Melanotus*, *Perothops* and *Perimecus*, which he was proposing, merited a new name. As far as I can discover the name *Cratonychus* does not appear in Castelnau's work. *Priopus* was not adopted by other workers who continued for some years to employ *Cratonychus* Dejean (see p. 57) for Elaterids with pectinate claws.

When Candèze (1860: 291) transferred *frontalis* to the new genus *Diploconus* and included the remaining *Priopus* species in *Melanotus* he recorded *Priopus* as a synonym of *Melanotus*, a perfectly reasonable action as at that time no type species had been designated for *Priopus*. Examination of Candèze' work has shown that when he dismantled a genus, transferring the included species to two or more senior genera, it was his custom to list the junior name as a synonym of the genus to which he had transferred the larger number of species although on some occasions the junior name appears as a synonym of more than one genus. In this case he appears to have been of the opinion that he had disposed of the name *Priopus* and was under no obligation to employ it for his new genus. The Schenkling catalogue (1927: 271) follows Candèze's example, listing *Priopus* as a synonym of *Melanotus* despite the fact that *frontalis* Castelnau, which Hyslop (1921: 66) had designated as the type species of *Priopus*, appears under *Neodiploconus*. Since that time the name seems to have been completely ignored.

As there is no doubt that *frontalis* and *peregrinus*, the type species of *Priopus* and *Diploconus*, are congeneric it follows that *Priopus* is the valid name for the genus-group taxon at present known as *Neodiploconus*. The synonymy has been implicit since Hyslop (1921: 666) designated *frontalis* as the type species of *Priopus* but it has never been formally stated or recorded. This omission is supplied here.

While a case could perhaps be made for requesting the *International Commission on Zoological Nomenclature* to suppress *Priopus* on the grounds that it has not been used as a senior synonym of a name in general current use, I am of the opinion that strict application of the Principle of Priority would not disturb the stability of Elaterid nomenclature. Although a number of new species has been attributed to *Neodiploconus* it has not been the subject of a revision or other major study and, with the possible exception of *rubidus* Erichson (see p. 84), the included species are not known to be of economic importance. The reinstatement of *Priopus* would have the added advantage of removing an unnecessary replacement name from current usage. *Priopus* Hope (1860: 73) recorded by Neave (1940: 894) appears in a list and is without doubt a misprint for *Prioscelis* Hope which is described and discussed later in the same work (1860: 128).

Notes on the genera and subgenera placed in synonymy with *Priopus*

Diploconus was established by Candèze for 11 species differing from *Melanotus* in that the pronotosternal sutures are not channelled anteriorly, the pronotum lacks posterior lateral incisions and the posterior free margin of each metacoxal plate has a tooth at or near the middle of its length. Hyslop (1921: 659) believed that Haekel's use of *Diploconus* for a Radiolarian antedated that of Candèze and, unaware that *Priopus* was an available replacement name, proposed *Neodiploconus* for the Elaterid genus. Investigations have shown that Hyslop was mistaken in his belief. The title page of Candèze' work bears the date 'Juillet 1860' whereas Haekel did not read the paper in which he described *Diploconus* until December 13th of the same year. The title page of the *Monatsberichte* [for 1860] in which the paper appears bears the date 1861, a fact which appears to have been overlooked by Hyslop and more recent workers. Why Hyslop failed to recognise that *Priopus* was available as a replacement name for *Diploconus* is unknown. Possibly he was confused by the fact that Candèze (1860: 290; 1890: 140), and also Schwarz (1906: 186), listed *Priopus* as a synonym of *Melanotus* (see above).

Thaumastiellus Schwarz was established for *bioculatus*, a new melanotine species in which the prothorax lacks lateral carinae (#6,2). Fleutiaux (1933: 206) redefined *Thaumastiellus* to include those species which resemble *Neodiploconus* in that there are no lateral incisions on the posterior margin of the pronotum and the pronotosternal sutures are 'closed' (i.e. #10,2) but which differ from that genus in that the posterior margin of the metacoxal plate lacks a tooth (#17,2). He divided the genus into 2 subgenera: *Thaumastiellus* s.str. for species in which the prothorax is without lateral carinae and *Pulchronotus* for species in which lateral carinae are present. Strangely Fleutiaux in-

cluded *Diploconus mirabilis* Fleutiaux in *Thaumastiellus* s.str. despite the fact that the description states that short posterior lateral prothoracic carinae are present. *D.pulchellus*, which has similar short carinae, is not mentioned, presumably because it was described from Yunnan and does not occur in French Indochina (= Cambodia, Laos & Vietnam), the region with which Fleutiaux was concerned in that work. The investigations undertaken in connection with the present work have shown that the character states (#6,1 & 6,2 see p. 93, and #17,1 & 17,2 see p. 94) used to distinguish *Thaumastiellus* and *Pulchronotus* are very variable and that the retention of these taxa, at either generic or subgeneric rank, cannot be justified.

Ploconides Fleutiaux. This subgenus was erected for a *Neodiploconus* species in which the apex of each elytron is entire. Examination of a syntype of the type species, *spiloderus* Candèze, has shown that the apices of the elytra are very feebly emarginate and the same is true of many other included species. Specimens are known in which the apices of the elytra are asymmetrical. In my opinion there is no justification for the retention of the subgenus.

DISTRIBUTION. The genus occurs in the eastern Indomalayan and the Oceanic realms. It has also been recorded from Japan (Miwa, 1927: 110; Ohira, 1967: 37).

BIOLOGY AND HABITS. Nothing is known of the biology or habits of *Priopus* species. The identity of *Melanotus (Neodiploconus) rubidus* recorded by Blunk & Muhlmann (1954) is uncertain (see p. 52). The confusion, which probably dates back to Candèze' misidentification (see *Melanotus candezei* p. 62), is perpetuated by reference collections, some containing the true *Priopus rubidus* and others *Melanotus* specimens bearing the same specific name.

An annotated list of *Priopus* species examined and notes on some other species included in the genus

The Schenkling catalogue lists 73 nominal species, of which 4 are synonyms, in *Neodiploconus* and *Thaumastiellus* which are here treated as synonyms of *Priopus*. Some 30 *Neodiploconus* and 1 *Thaumastiellus* species have been described since the publication of the catalogue. Examples of 42 species have been examined. Three species described as *Elater* by Hope are now assigned to the genus and one species is transferred to the genus from *Melanotus*.

aequalis (Candèze). Lectotype ♂, designated by Van Zwaluwenburg (1959: 391) (MCSN). **Comb. n.**

ambustus (Candèze), 1 paralectotype (not cotype as recorded by Van Zwaluwenburg, 1957: 931), SUMATRA: Diploconus ambustus Cdz. n. sp. Sumatra, Snellen [Candèze]. Lectotype ♀, designated by Van Zwaluwenburg (1975: 391) (RNH). **Comb. n.**

As Candèze (1865: 46, after *erythropus*) remarks that he received *ambustus*, *erythropus* and *melanopterus* material from Snellen van Vollenhoven, who was curator at the RNH, Leiden from 1854–73, it seems reasonable to assume that the paralectotype recorded above is one retained by Candèze for his own collection. The specimen is in very poor condition.

angulatus (Candèze). Type material (?IRSNB). **Comb. n.**

The type material cannot be found in the BMNH collection and the species is not recorded in either Waterhouse's or Janson's lists (see p. 54) of the Candèze material.

For a note on monts Mao-son and Monts Mau-Son, the localities recorded by Fleutiaux (1918: 231; 1933: 213), see *mirabilis* p. 82.

{*apicalis* (Schwarz, 1902(i)b not 1901, see references). 1 ♂ syntype (PI, confirmed by Gaedike, 1975: 18). **Comb. n.**}

ardjoenicus (Candèze). **Comb. n.**

umbilicatus Candeze, 1891. Type material (?IRSNB). Junior primary homonym of *umbilicatus* Candèze, 1875.

{*basalis* (Schwarz, 1901 not 1900, see references). Syntype material (?, not recorded as present in IP by Gaedike, 1975). **Comb. n.**}

basilaris (Schenkling). **Comb. n.**

brevis basalis Fleutiaux, 1918. Type material (?MNHN). Junior primary homonym of *basalis* Schwarz, 1901. Raised to specific status and transferred to *Thaumastiellus* (*Pulchronotus*) by Fleutiaux, 1933: 207.

See also *brevis* Candèze.

bioculatus (Schwarz) (*Thaumastiellus*). Holotype (IP, recorded by Gaedike, 1975: 22). (030). **Comb. n.**

Interpretation of the species is based on a specimen from Assam (Naga Hills), 4000–6000 ft (*Doherty*),determined by C. J. Gahan.

The type locality is Tonkin, [N. Vietnam] Montes Mauson. There seems little doubt that this is a mis-spelling of 'Man-Son' (see *mirabilis*.).

boninensis (Van Zwaluwenburg, 1957: 64) (*Neodiploconus*). Holotype ♂ (USNM), paratype ♂ (?BPBM). (038). **Comb. n.**

Interpretation of the species is based on a ♀ from Ogasawara [Bonin Is], 2.vii.1973 (*Y.*

Kusui) determined by Ohira. This is the only *Priopus* specimen known to me in which in ventral view the posterior angles of the pronotum are truncate at the apex (#26,2). Whether this is individual variation or characteristic of the species is unknown. For the present the species is retained in *Priopus*.

brevis (Candèze, 1897 not 1896, see references). Type material (?IRSNB). **Comb. n.**

Transferred to *Thaumastiellus (Pulchronotus)* by Fleutiaux (1933: 207). Specimens of this species and of *basilaris* Schenkling from Tonkin, Lac Tho, determined by Fleutiaux (see localities listed 1933: 207), differ not only in the colour of the elytra (*op. cit.*: 208) but also in the appearance of the aedeagus.

carneus (Candèze, 1897 not 1896, see references), 6 syntypes, WEST MALAYSIA: 1 ♀ (species 1), carneus Cand. Johore, Poulo-pin. [Candèze yellow-bordered determination label], (14 mm). 1 ♀ (species 2), Johore (16 mm). 1 ♂ (species 3), Johore (13 mm). 1 ♂ (species 3), Poulo Pinang [cut from yellow-bordered label] (13 mm). 1 ?sex (contents of abdomen missing, probably species 3), Johore (14 mm). 1 ♀ (*Anchiszombatya* sp.), Johore (13 mm) (IRSNB). **Comb.n.**

The published locality is 'Johore, Pulo-Pinang'. Candèze records the size range as 12–15 mm, but despite the discrepancy in size I believe that the above 6 specimens are the 'demi-douzaine' to which Candèze refers in his description.

All the specimens also bear the IRSNB's curatorial Candèze determination label. Fleutiaux appears to have examined the specimens in 1931 as all the specimens carry his labels with this date. He labelled the ♀ with Candèze determination label 'Type', the large ♀ from Jahore 'carneus Cdz pars', and the remainder with the specific name. As far as I am aware he did not publish a lectotype designation.

The syntypes belong to at least 4 species. Those recorded above as species 3 agree best with the description in that the puncturation of the prothorax is coarser than that of specimens in the IRSNB [mis]identified as *frontalis* Castelnau by Candèze.

In my opinion the two male 'species 3' are the only possible candidates for lectotype status. The specimens bear so close a resemblance to *porrectus* Erichson that I suspect the two species may be conspecific but further critical studies are required before a decision can be made.

ciprinus (Candèze), 1 ♂ ?syntype, PHILIPPINE Is: Luzon; Diploconus ciprinus Cdz [Candèze, the name of the collector is illegible]. (021). **Comb.n.**

Candèze remarks that the species was discovered by Semper whose collection he acquired in 1875. The material should therefore be in the IRSNB but I believe the specimen recorded above may have been retained by Candèze at the time of the description (1865).

The species is easily recognized by the outline of the last visible abdominal sternite which has a small pointed projection on either side of the mid line in both sexes (#20,1, Fig. 30). This species bears a strong superficial resemblance to *Melanoxanthus inconditus* Candèze which also occurs in the Philippines.

consanguineus (Candèze), 1 ♂ syntype 'Cratonychus consanguineus mihi, pallipes Latreille, h. in Amer. ins. ?, D. Latreille' [Dejean, green label]. **Comb. n.**

Candeze (186): 294) remarks that in the Dejean collection the locality is marked as possibly erroneous and records the locality as 'Malaisie'. The syntype is not unlike undetermined specimens from that region, but so far I have been unable to find any conspecific specimens.

coracinus (Candèze). 1 ♀ ?syntype labelled Assam; Janson Coll. ex Candèze 1903.130; Diploconus coracinus Cdz, Siam, Cast. [Candèze yellow-bordered label]. **Comb. n.**

The published locality is Assam but in his catalogue Candèze (1891: 139) records the locality as 'Indochine', a term he is known to have used to include Cambodia, Laos, Thailand and Vietnam. Except for the size (14 mm not 15 mm) the specimen agrees very well with the description and, unless a specimen with a better claim to syntype status is found in the IRSNB, I believe it should be considered as a suitable candidate for designation as lectotype.

The BMNH collection contains specimens from Siam and Burma which are believed to be conspecific.

{*depressus* (Schwarz, 1902(i)b not 1901, see references). 1 syntype (IP, recorded by Gaedike, 1985: 29). **Comb. n.**}

diversus Fleutiaux, 1933: 210. Syntype material (?MNHN). **Comb. n.**

elegans (Szombathy). ♂ & ♀ syntypes (TM). **Comb. n.**

This species was transferred to *Thaumastiellus (Pulchronotus)* by Ohira (1968: 367).

Fleutiaux (1933: 208) remarks that this species appears to bear a close resemblance to *superbus* Fleutiaux.

enganensis (Candèze), 1 ♂ (12 mm), 1 ♀ (11 mm) paralectotypes, ENGGANO: Bua-bua, v, vi 1891 (*Modigliani*) (IRSNB). **Comb. n.**

The female bears Candèze' yellow-bordered

determination label 'n. sp. 1892 Enganensis Cand. Engano G.[?Gestro]' and Van Zwaluwenburg's 1967 lectotype label.

As Van Zwaluwenburg (1959: 392) designated one of two specimens in the MCSN, Genoa as the lectotype the above specimen must have been labelled in error. In view of the fact that Candèze reports that numerous specimens were collected it seems probable that more syntypes (possibly with the published measurements of 13–14 mm) are standing unrecognized in the MCSN.

One of the three 'type' specimens (♂) in the IRSNB to which Van Zwaluwenburg refers bears the locality Kifa-juc, v. not Bua-bua. Bua-bua is a flat-topped low mountain in the centre of the island. Kifa-juc does not appear on Modigliani's (1894) map. I believe it is an alternative spelling of Chifaiauc, the name given to the area to the east of Bua-bua between the River Malaconni and the coast.

The apices of the elytra are truncate rather than emarginate, and those of the female less strongly so than the male.

erythropus (Candèze), 1 ♀ paralectotype. **Comb. n.**

The specimen is believed to be a paralectotype because Candèze's determination label carries the name Snellen. See *ambustus* (p. 80).

exquisitus (Candèze), 1 ♀ syntype. **Comb. n.**

{*fleutiauxi* (Van Zwaluwenburg, 1934: 596). [Replacement name for *nitidus* Fleutiaux.]. **Comb. n.**}

nitidus Fleutiaux, 1916. Syntype material (?USNM, ?MNHN). Junior primary homonym of *nitidus* Schwarz, 1902.

frontalis Castelnau, 1 ♀ syntype, Ind. Or. (NMV). [Transferred to *Diploconus* by Candèze, 1860: 291.] (024). **Comb. rev.**

The type species of *Priopus*. Dr Neboiss (pers. comm. xi.87) reports that though the specimen is believed to come from the Castelnau collection there is now no generic label for *Priopus* and that the above specimen stands under *Melanotus*. In view of its provenance and the fact that it agrees with the description I believe that its acceptance as syntype is justified.

The published locality is Java. The specimen is pinned on a card onto which is stuck a small label with the words 'Frontalis (Ind. or.)' in an unidentified manuscript hand.

Examination of specimens in the BMNH and IRSNB determined by Candèze has shown that he misidentified the species. In all the specimens the elytra are emarginate at the apex whereas those of *frontalis* are simple. The material includes a number of different *Priopus* species with a superficial resemblance to *porrectus* and *prominens* Erichson and a few *Anchiszombatya* species; all are unknown to me.

Candèze (1860: 292) treated *Cratonychus porrectus* Erichson as a synonym of *frontalis* but examination of the type material of *porrectus* has shown it is not conspecific with either *frontalis* Castelnau or Candèze' interpretation of that species.

{*hebetatus* (Candèze, 1897 not 1896, see references). Lectotype ♂ (not type), designated by Van Zwaluwenburg (1959: 392). (IRSNB). **Comb. n.**}.

homostictus (Candèze), lectotype (not type) ♀ (confirmed), designated by Van Zwaluwenburg (1959: 393). (022). **Comb. n.**

Lateral aspect of head Fig. 8; mesocoxa and mesocoxal cavity Fig. 26; posterior coxal plate Fig. 35.

kubotai (Suzuki, 1978: 440) (*Thaumastiellus (Pulchronotus)*). Holotype & allotype (Suzuki coll.). **Comb. n.**

Interpretation of the species is based on a specimen identified by Suzuki.

lateralis (Schwarz). 1 syntype (IP, recorded by Gaedike, 1985: 42). **Comb. n.**

Interpretation of the species is based on 1 ♂, 1 ?sex (abdomen lost) identified from the description by Gahan. Both specimens also carry Candèze's determination label '*Diploconus melanopleurus*' (unpublished).

leveri (Van Zwaluwenburg, 1940: 127) (*Neodiploconus*), holotype ♂. (037). **Comb. n.**

miniaticollis (Hope, 1831: 25) (*Elater*), 1 ♀ syntype, NEPAL: Nepal [yellow paper]; miniaticollis Hope [? Hope]; miniaticollis Hope 4035; Hardwicke Bequest. **Comb. n.**

This species has not previously been recorded in any published catalogue. The number 4035 refers to volume 12 of a quarto manuscript catalogue entitled *Annotated copy of Ms Catalogue of Coleoptera Coll.* (circa 1842) in the possession of the BMNH.

miniatus (Hope, 1831: 25) (*Elater*), 1 ♀ syntype, NEPAL: Nepal [yellow paper]; miniatus Hope [?Hope]; miniatus Hope 4038. **Comb. n.**

The species has not previously been recorded in any catalogue. The number 4038 refers to volume 13 of the catalogue mentioned under *miniaticollis* above.

mirabilis (Fleutiaux). Holotype (?MNHN). **Comb. n.**

Transferred from *Neodiploconus* to *Thaumastiellus (Thaumastiellus)* by Fleutiaux (1933: 206).

Interpretation of the species is based on a ♂, Tonkin, Montes Manson, April, Mai, 2–3000' (*H. Fruhstorfer*). The specimen (which was

determined by the author) agrees well with the description except that the lateral carinae of the pronotum extend from the posterior to the anterior angle (cf. Fleutiaux (1923: 12) 'caréné latéralment seulment en arrière').

Fruhstorfer spent most of April and May 1900 collecting in and around the Man-Son range of mountains which lies east of Lang-Son near the frontier with China (Fruhstorfer, 1905: 316–370). The range appears on the map of Tonkin in the *Atlas des Colonies Francaises* (see p. 112). This is probably the same locality as that recorded as 'Montes Mauson' by Schwarz in his description of *bioculatus* (p. 80) and as Monts Mauson by Fleutiaux (1933: 221) as one of the type localities of *M. rugosiventris* (p. 71). The localities recorded as monts Mao-son (Fleutuaux, 1918: 231) and monts Mau-Son (*Fruhstorfer*) (Fleutiaux, 1933: 213) for *angulatus* probably also refer to the same place.

niger (Van Zwaluwenburg, 1934: 596) (*Neodiploconus*), holotype ♂ (confirmed). **Comb. n.**

This species is unusual in that in ventral view the posterior angles of the pronotum are wedge-shaped (Fig. 12).

Lateral aspect of head Fig. 2; ventral aspect of left hand side of prothorax Fig. 21.

nigerrimus (Fleutiaux, 1903 not 1902, see bibliography). Type material (?MNHN). (041). **Comb. n.**

nigricornis (Candèze), 1 syntype [abdomen missing], JAVA; Horsfield, 60.15 [registration number indicating that the specimen was presented by the Secretary of the India Board]; D. nigricornis Cdz [Candèze]. **Comb. n.**

nigrifrons (Schwarz). Holotype (IP, recorded by Gaedike, 1985: 50). **Comb. n.**

{*nitidicollis* (Schwarz, 1901 not 1900, see references). Holotype (IP, recorded by Gaedike, 1985: 52). **Comb. n.**}

nitidus (Candèze) (*Melanotus*), holotype ?♂ (abdomen missing), 'India or.'; small square of yellow paper; Melanotus nitidus Cdz [Candèze]; Janson coll. ex Candèze, 1903. 130 [BMNH registration label]. **Comb. n.**

The species was described from 'Indes Orientales' which includes eastern India, Burma, Thailand, Cambodia, Vietnam and E. and W. Malaysia. In the last century small yellow labels were often attached to specimens to indicate that they came from the Orient.

Why Candèze included *nitidus* in *Melanotus* when, as he remarks himself ('les sillons basilaires latéraux nuls'), the species lacks basal lateral incisions on the prothorax, one of the chief diagnostic characteristics of the genus, and why he retained the specimen which he records as having been sent to him by 'M[onsieur] A. White of the Muséum de Londres' [= British Museum, Bloomsbury later BMNH] remains a mystery. It is possible that the Janson collection label was attached in error at a later date.

{*nitidus* Fleutiaux, 1916: 231. Junior primary homonym of *nitidus* Schwarz, 1902: 274. See (*fleutiauxi* Van Zwaluwenburg}

{*nitidus* (Schwarz, 1902(vii): 274), Junior secondary homonym of *P. nitidus* (Candèze, 1860, from *Melanotus*).} See {*schwarzi*}.

ornatus (Candèze). Holotype ?♀ (?MCSN). (027) **Comb. n.**

Transferred to *Thaumastiellus (Pulchronotus)* by Fleutiaux (1933: 207).

Mucro and anterior coxal cavity Fig. 17; posterior coxal plate Fig. 36.

peregrinus (Candèze), lectotype ♀ (not type), designated by Van Zwaluwenburg (1959: 394). (020). **Comb. n.**

Type species of *Diploconus*. Anterior aspect of head Fig. 7; dorsal and ventral aspect of posterior angles of pronotum Figs 11, 11a; mucro and anterior coxal cavity Fig. 16; vetral aspect of left hand side of pronotum Fig. 20; mesocoxal cavity Fig. 25; posterior coxal plate Fig. 34.

plagiatus (Candèze), 1 ♀ syntype, JAVA: Horsfield, 60.15 [registration number indicating that the specimen was presented by the Secretary of the India Board]; D.plagiatus Cdz [Candèze]. **Comb. n.**

porrectus (Erichson), 1 ♀ syntype, BORNEO (*de Haan*) [label and handwriting as *prominens* below], 17047 [museum registration number] (MNHU). **Sp. rev., comb. n.**

Examination of the type material has shown that Candèze (1860: 292) was mistaken in his belief that *porrectus* Erichson is conspecific with *frontalis* Erichson. Candèze also misinterpreted *porrectus*. A ♀ from Java in the BMNH collection bearing a Candèze yellow-bordered determination label is an *Anchiszombatya* species (see p. 88).

prominens (Erichson), 2 ♀ syntypes, JAVA: 17409 [museum registration number]; one specimen bears a yellow label with the words 'prominens Er. Java, de Haan' in a handwriting closely resembling that of Erichson asdepicted by Horn & Kahle, 1935: pl. 16, fig. 30 (MNHU). (025). **Comb. n.**

Anterior aspect of head Fig. 9.

pulchellus (Fleutiaux). Type material (?MNHN). **Comb. n.**

Interpretation of the species is based on 2 ♀, CHINA: Sud Yunnan, Tche-Ping-Tcheou, determined by Fleutiaux.

Although the description states 'caréné latéralment seulment en arrière' a faint but perceptible carina extends from the posterior to the anterior angle of the pronotum. The posterior angles of the pronotum, described as 'brièvment carénés', each bears two short carinae.

robustus (Szombathy). ♂ & ♀ syntypes (TM). **Comb. n.**

The only specimen of this species known to me is a ♂ from Borneo, Sarawak, R. Kapah trib. of R. Tinjar, 2.x.1932 (*Hobby & Moore*, Oxford University Expedition), identified by Fleutiaux. It is undoubtedly *peregrinus*. Whether the two species are synonymous can be ascertained only by examination of the type material.

rubidus (Erichson), 1 ♂ syntype, JAVA: 17409 [museum registration number]; rubidus Er. Java, Buq. [label and handwriting as on *prominens* above] [transferred to *Diploconus* by Schwarz, 1902(i)b: 328] (NMHU). **Comb. n.**

Candèze (1860: 327) misidentified *rubidus*, which he included in *Melanotus*, a fact noticed by Schwarz (1902(i)b: 328) when he examined *rubidus* material from the Candèze collection. See *M. candezei* p. 62.

It is not known whether this is the Javanese pest to which Reh (1912) and Blunk & Muhlmann (1954) refer (see p. 52).

rubriventris (Van Zwaluwenburg, 1940: 128) (*Neodiploconus*), holotype ♂. **Comb. n.**

{*ruficollis* (Schwarz, 1901 not 1900, see references). 1 ♀ syntype (IP, recorded by Gaedike, 1985: 59). **Comb. n.**}

?*rufus* (Candèze). **Comb. n.**

The description is based on an unrecorded number of specimens, 11 mm long, from Java. As the type material cannot be found in either the BMNH or IRSNB, the identity of the species remains uncertain. The BMNH collections contain a ♂ from Batchian (= Batjan, Molucca Archipelago), 10 mm in length, bearing Candèze' determination label. A ♂ from the same locality with Candèze' yellow-bordered determination label in the IRSNB measures 14 mm; differences in appearance of the aedeagus suggest that the specimens are not conspecific.

{*schwarzi* **nom. n.**}

{*nitidus* (Schwarz, 1902(vii): 274). 4 syntypes (IP, recorded by Gaedike, 1985: 52). Junior secondary homonym of *Priopus nitidus* (Candèze, 1860). The two specimens from Manus Is recorded by Van Zwaluwenburg (1934: 596) cannot be found in the BMNH collections.

spiloderus (Candèze), 1 ♂ syntype, WEST MALAYSIA: Malacca, Diploconus spiloderus Cdz Cast[elnau] [Candèze]. (023). **Comb. n.**

Candèze remarks that the species was caught in some numbers by de Castelnau.

{*superbus* Fleutiaux, 1895 not 1894, see references. Type material (?MNHU). **Comb. rev.**}

When Fleutiaux (1933: 208) transferred the species to *Thaumastiellus (Pulchronotus)* he remarked that there does not seem to be a great difference between this species and *elegans* (Szombathy, 1910).

tersus (Candèze, 1897 not 1896, see references). Type material (?IRSNB). **Comb. n.**

tricolor (Candeze), lectotype (not type) ♀, designated by Van Zwaluwenburg (1959: 394). SUMATRA: n.sp. 1895 tricolor Cand. Sumatra, Staudinger [Candèze yellow-bordered label] (IRSNB). **Comb. n.**

There is a broad impunctate band on the inner margin of the hypomeron which looks remarkably like the impunctate border characteristic of *Melanotus* species, but there is no distinct demarcation line between it and the remainder of the hypomeron.

trimaculatus (Hope, 1831: 25) (*Elater*). 2 syntypes, NEPAL: 1 ♂, Nepal [yellow paper]; trimaculatus Hope [?Hope]; Hardwicke Bequest. 1 ♂, Nepal [yellow paper], trimaculatus Hope 4037. **Comb. n.**

This species has not previously been recorded in any catalogue. The number 4037 refers to volume 13 of a quarto manuscript catalogue entitled *Annotated copy of Ms Catalogue of Coleoptera Coll.* (circa 1842) in the possession of the BMNH.

NEOFLEUTIAUXIA Platia

Fleutiauxia Platia, 1986: 1. Type species: *Fleutiauxia fruhstorferi* Platia, 1986, by original designation. [Homonym of *Fleutiauxia* Laboissière, 1933 (Galerucinae).]

Neofleutiauxia Platia, 1987: 34. [Replacement name for *Fleutiauxia* Platia.]

GENERIC DIAGNOSIS. Pronotum without basal lateral incisions (#7,2, as Fig. 11). In ventral view, posterior angles ofprothorax terminate in a point (#26,1, as Fig. 11a). Inner margin of hypomeron without a well-defined narrow impunctate border; if the portion of hypomeron adjacent to pronotosternal suture is impunctate the impunctate area is not separated from rest of hypomeron by a distinct groove or raised above it (#10,2, as Figs 20, 21). Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2, as Fig. 27). Third tarsal segment dorsoventrally depressed with ventral prolongation

extending beneath entire length of 4th segment (#19,1, well illustrated by Platia, 1986: 7, fig. 2).

OTHER CHARACTER STATES COMMON TO THE INCLUDED SPECIES. Platia's generic diagnosis indicates that in all five species antennal segments 4–10 bear a longitudinal carina (#2,1, Platia, 1986: 7, fig. 3)), posterior angles of pronotum are bicarinate (#8,2, op. cit. fig 5), apices of elytra are indistinctly truncate (#11,1, op. cit. fig. 4), apices of lateral lobes of aedeagus are furnished with apical barbs (#23,1) and median lobe of aedeagus projects beyond lateral lobes by a distance somewhat greater than the length of the barbs (#24,1, op. cit.: 8, figs 9–11). In *fruhstorferi* and the undetermined specimens recorded below there is a carina extending from the posterior to the anterior angle of the pronotum (#6,1) and the suture between the meso- and metasternum is distinct (#16,2). It seems probable that all the described species possess this feature.

COMMENT. The only generic taxonomic character separating *Neofleutiauxia* from *Priopus* is the structure of the third tarsal segment. At present no species displaying an intermediate state are known but within the family the structure of the tarsus is notorious for the degree to which it is known to vary within a genus (see also Hayek, 1973: 114–116 concerning the Agrypninae) and it would not come as a surprise to hear of the discovery of such species. The retention of *Neofleutiauxia* would then no longer be justified.

Platia's descriptions suggest that the range of variation of the classic characters (shape of head, relative size of antennal segments, shape of pronotum etc.) resembles that found in all the other genera in the *Melanotus* group.

THE HISTORY OF THE GENUS. The genus was erected for five new species from the Celebes [Sulawesi] and Java. The author compares the genus with two other Melanotine genera (*Psellis* Candèze from Reunion and Mauritius and *Szombatya*, a new genus from Taiwan) in which the third tarsal segment is 'dilated and absorbing entirely the fourth, very short joint'. The third tarsal segment of *Psellis* is dorsoventrally depressed but the ventral prolongation does not extend beneath the entire length of the 4th segment (#19,3, Figs. 40, 41) and that of *Szombatia* is more or less cylindrical and obliquely truncate distally with a small membranous ventral lobe (#19,2) whereas that of *Neofleutiauxia* species is dorso-ventrally depressed with the ventral prolongation extending beneath the entire length of the 4th segment (#19,1). Platia distinguishes *Neofleutiauxia* from the other two genera by the 'closed' [i.e. the inner margin of the hypomeron without an impunctate border which is angled meso-dorsad anteriorly] prosternal suture, apparently unaware that this character state also occurs in *Priopus* species. Another character state which occurs in both *Neofleutiauxia* and *Priopus* is the absence of lateral incisions in the posterior margin of the pronotum (#7,2, Fig. 11). This feature is not mentioned in the decription, but is clearly visible in Platia's illustration (1986: fig. 1).

DISTRIBUTION. North Sulawesi, West Java, Amboina.

BIOLOGY AND HABITS. Unknown.

SPECIES INCLUDED IN THE GENUS. Platia included 5 new species (*fruhstorferi*, *girardi*, *marijosae*, *osellai* and *valentinae*) in the genus. Through the kindness of Dr Platia I have been able to examine the male paratype of *fruhstorferi* (005) in his collection.

The BMNH collection contains the following three as yet unidentified specimens in rather poor condition:

N. SULAWESI: 2 ♂ Manado and Tondano (*Wallace*)

AMBOINA: 1 ♀ (*Lorquin*); (*Wallace*). Lorquin collected in the hospital grounds in Amboina in 1862 (Boisduval, 1873: 9;Gimmel, 1904: 203). The second label bearing Wallace' name was probably attached by mistake.

SZOMBATYA Platia

Szombatya Platia, 1986: 2. Type species: *Psellis formosana* Szombathy, by monotypy.

GENERIC DIAGNOSIS. Pronotum without basal lateral incisions (#7,2, as Fig. 11). In ventral view, posterior angles of prothorax truncate at apex (#26,2, as Fig. 10a). Inner margin of hypomeron with a well-defined narrow, completely, or almost completely, impunctate border separated from rest of hypomeron by a distinct groove or raised above it (#10,1, as Fig. 18). Inner border of hypomeron extends beyond anterior divergence point of hypomeron and prosternum, forming anterior free border of hypomeron which slopes meso-dorsad and may be concave (#29,1, as Figs 18, 18a). Pronotosternal suture not situated at base of a groove (#27, 2), but inner border of hypomeron slopes mesad-dorsad within anterior two-thirds of its length to form a shallow channel or groove (#28,1, as Figs 18, 18a); inner wall of groove, formed by lateral margin of the prosternum, is punctured. Ventral surface of last visible abdominal sternite with two or more large punctures (#21,1, Fig.31). Third tarsal segment with a

small distal ventral prolongation or lobe which does not extend beneath entire length of 4th segment (#19,2).

COMMENTS. Szombathy described the scutellum as cordiform but examination of the type has shown that the shape does not differ significantly from the majority of *Melanotus* species in which it is shield-shaped. The difference lies in the fact that the anterior margin is notched in the mid line and the notch is continued as an impression on the anterior half of the disk of the scutellum. A similar notch and groove are present in *Melanotus albernus* Candèze, *gumbatae* Van Zwaluwenburg, *mouldsi* Calder and *Metriaulacus nigrolateritus* Schwarz, *badiipennis* and *gobius* Candèze. The suture between the meso- and metasternum is distinct (#16,2) and the apex of the last visible abdominal sternite is bluntly arcuate (#20,3, Fig 31). In the type specimen the two large punctures on either side of the mid line of the last visible sternite are of slightly different sizes and the punctures immediately adjacent to them are also larger than those covering the rest of the surface of the sternite. The only ♂ known to me has five large punctures of which one of the outer ones is smaller than the rest (Fig. 31). In the other specimens recorded below the Singapore ♀ has two large punctures, one ♀ from Borneo a row of four which are more or less the same size and lie close together and the other a row of five which are more widely spaced with the outer punctures slightly, and the middle puncture considerably, smaller than the others. It seems probable that the number and size of the punctures is subject to individual variation. Slightly enlarged punctures have been observed in some specimens of *Priopus ciprinus* (Fig. 30). It is strange that Szombathy did not notice the large punctures, but until recently most workers seem to have done no more than glance at the underside to determine the colour of the legs and, occasionally, the outline of the posterior coxal plate. The genus is of interest as it occupies an intermediate position between *Melanotus* and *Priopus*. It possesses two generic taxonomic characters of the former in that in ventral view the posterior angles of the prothorax are truncate (#26,2) and there is a well-defined impunctate border on the inner margin of the hypomeron (#10,1), and one generic taxonomic character of the latter in that there are no lateral incisions in the basal margin of the pronotum (#7,2).

THE HISTORY OF THE GENUS. The genus was erected for a single species, originally assigned to *Psellis* but differing from that genus in that the frons is projecting instead of depressed, the scutellum 'cordate' (see above) instead of shield-shaped and in the presence of 'two semicircular (sic, they are slightly elongate) holes separated by a slightly longitudinal carina' on the last visible abdominal sternite of the female, the only sex known at the time of the description. The genus also differs from *Psellis* in that the third tarsal segment is not dorsoventrally depressed but obliquely truncate distally. Szombathy's (1910: 446, fig.) figure is misleading in that the ventral prolongation of the third tarsal segment is much smaller than shown and does not extend beneath the entire length of the 4th segment.

DISTRIBUTION. Taiwan, but probably more widespread, see species examined below.

BIOLOGY AND HABITS. Unknown.

Species examined

One species has been described.

formosana (Szombathy), holotype ♀, TAIWAN: Kosempo [= Kōsen, see Esaki, 1941: 86), 9.vi.08 (*Sauter*) (TM). [Transferred to *Szombatya* by Platia, 1986: 2.] (029)

The gazetteer lists two villages with the name Kōsen. One at 23° 06′ N 120° 34′ E and the other at 23° 05′ N 120° 35′ E. The name on Szombathy's manuscript determination label appears to be '*formosiaca*'. The specimen also bears Platia's determination label.

The BMNH collections contain the following undetermined *Szombatya* specimens which appear to belong to different species:

WEST MALASIA: 1 ♀, Singapore (*Saunders*).
BORNEO: 2 ♀, Brunei, Bukit Sulang, nr Lamunin, viii-ix.1982 (*Stork*).
INDIA: 1 ♀, Assam, Naga Hills, 4,000–5000 ft. (*Doherty*).

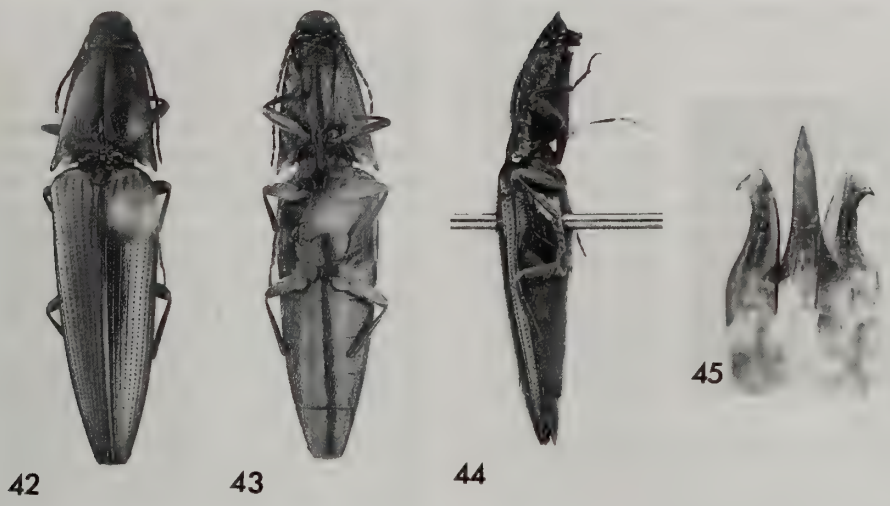
Last visible abdominal sternite Fig. 31.

Description of these species is deferred until more specimens of both sexes and in better condition become available.

ANCHISZOMBATYA gen. n.

Type species: *Anchiszombatya porrectifrons* n. sp.

DIAGNOSIS. Pronotum without basal lateral incisions (#7,2, as Fig. 11, Fig. 42). In ventral view, posterior angles of prothorax terminate in a point (#26,1, as Fig 11a, Fig. 43). Inner margin of the hypomeron with a well-defined narrow, completely, or almost completely, impunctate border separated from rest of hypomeron by a distinct groove



Figs 42–45 *Anchiszombatya porrectifrons*. (42) dorsal aspect,(43) ventral aspect, (44) lateral aspect, (45) aedeagus.

or raised above it (#10,1, Figs 22, 43). Inner border of hypomeron does not extend beyond anterior divergence point of hypomeron and prosternum, or if it is prolonged anteriorly it becomes much narrower and lies in same plane as adjoining portion of hypomeron (#29,2, Fig. 22). Pronotosternal suture not situated at base of a groove (#27,2) and inner border of hypomeron does not slope meso-dorsad within anterior two-thirds of its length (#28,2). Ventral surface of last visible abdominal sternite without large punctures or pits near apex (#21,2, as Fig. 27). Third tarsal segment simple, vertically or obliquely truncate distally (#19,2, as Figs 38, 39).

COMMENTS. Almost all the *Anchiszombatya* specimens known to me have previously been assigned to *Priopus* (as *Neodiploconus*), presumably because they lack incisions on the posterior margin of the pronotum. They also resemble *Priopus* in that in ventral view the posteror angles of the pronotum terminate in a point. The chief difference between the two genera lies in a previously unnoticed character, the presence of an impunctate border on the inner margin of the hypomeron. The genus can be distinguished from *Melanotus*, which possesses a similar border, in that the border either terminates at or very near the anterior divergence point of the hypomeron and prosternum or continues as a much narrower band which is not angled meso-dorsad in the anterior two-thirds of its length.

DISTRIBUTION. Java, Borneo.

BIOLOGY AND HABITS. Unknown.

Species included in the genus

One species is here described. Whether the specimen from Borneo recorded below belongs to the same species is uncertain.

Anchiszombatya porrectifrons sp. n. (013)

Length: ♂ 11–12 mm, ♀ 12–14 mm.

Coloration chestnut-brown, head and anterior margin of the head and pronotum of the type and the majority of specimens blackish.

General appearance: Figs 42, 43, 44.

Dorsal aspect.

Head: puncturation of vertex and frons coarser and closer than that of pronotum, size and density of punctures variable but the majority separated by a distance less than their diameter. Frons projecting horizontally, anterior margin not depressed (#3,1). Nasale with a median raised area with convergent cariniform margins (#30,2, as Fig. 8), parantennal pits absent (#4,2). Antennae attaining apex of posterior angles of pronotum (♂) or falling short by a distance approximately equal to half length of last segment (♀) (this feature is not entirely reliable as it is affected by the degree to which the head is extended, which is extremely difficult to judge). Antennal segments 2 and 3 subequal in length (#1,1), together as long as 4th segment, shiny compared to segments 4–10 which are triangular with a longitudinal carina on each face (#2,1); apical segment elongate-oval. Mandibles, which lack basal pits (#5,2), furnished with a single small tooth on blade.

Prothorax: lateral carinae present, extending from posterior to anterior angles (#6,1). Pronotum with a median longitudinal depression extending from posteror margin to within a short distance of anterior margin; punctures separated by more than one diameter except near anterior margin where the punctures are both coarser and closer; posterior angles bicarinate (#8,2).

Scutellum: steeply declivous to prescutum, anterior margin slightly arcuate (#9,3), lateral margins feebly emarginate, posterior margin arcuate.

Elytra: punctate-striate, interstriae with sparse small punctures. Apex of each elytron emarginate from suture to the 5th interstria (#11,2).

Ventral aspect.

Prothorax: punctures on hypomeron and prosternum intermediate in size between those on head and pronotum and separated by a distance equal to, or considerably greater than, their diameter. Ventral face of mucro slopes dorsoposteriad (#14,1) to about the same degree as posterior portion of prosternum slopes ventroposteriad towards base of mucro. Apex of mucro unevenly bifurcate with a larger dorsal projection.

Mesosternum: mesosternal groove feebly angled (#15,3, Fig. 24). Mesepimeron does not form part of margin of mesocoxal cavity (#13,1, Fig. 24), the junction between mesosternum and mesepimeron very short. Suture between mesosternum and metasternum distinct (#16,2). Metasternal puncturation fine and sparse.

Abdomen: punctures on sternites similar in size to those on metasternum but less widely separated; last visible sternite simple, apex bluntly arcuate (#20,3, as Fig. 27); tergites thin (#22,2).

Legs: femora not compressed (#18,2). Middle femora attain posterior lateral angles of metasternum and hind tibio-femoral articulation visible from above when legs are drawn up against body. Posterior free margin of metacoxal plate bears a distinct tooth within inner half of its length (#17,1, Fig. 37). Tarsi simple (#19,2, as Figs 38, 39).

Aedeagus (Fig. 45): lateral lobes with short apical barbs (#23,1), median lobe projecting beyond lateral lobe by a distance slightly greater than length of barbs of lateral lobes (#24,2).

Ovipositor with stout valves (#31,2).

MATERIAL EXAMINED

Holotype ♂, **Java**: Cratonychus porrectifrons mihi, h. Java, d. Leconte [Dejean, yellow paper]; Diploconus frontalis Cast. nec Candeze [?Blair or Bates]; Janson coll. ex Dejean, 1903–130 (BMNH). Length 12 mm.

Paratypes. **Java:** 1 ♀, M. porrectus Er. [Candèze]; Janson coll. ex Dejean, 1903–130; 1 ♂, 1 ♀, Janson coll, 1903–130; 1 ♀, Diploconus prominens Er. [Andrews], Andrewes Bequest, B.M. 1922–221; 1 ♀, same provenance; 1 ♂, Bantam [= Bantem] (BMNH); 2 ♀, Diploconus frontalis Cast. [one with curatorial label, 'det. E. Candèze' and the other 'rev. E. Fleutiaux']; 1 ♂, Tenggar [Mont Tengger, see *M. pulvereus* p. 00]; Diploconus frontalis Cast. [Fleutiaux]; 1 ♂, Java occidental (*Pasteur*); Diploconus frontalis [Fleutiaux] (IRSNB, all four stood as *N. frontalis* Castelnau in the Candèze collection).

ADDITIONAL MATERIAL EXAMINED

Borneo: 1 ♂, Sarawak, 9.iii.1912 (BMNH). The specimen differs from those from Java in that it is dark red-brown and the elytra appear to be less strongly emarginate at the apex. Although there does not appear to be any marked difference in the aedeagus I suspect it may belong to a different species.

The generic name is derived from '*Anchi*' (Greek, near) and *Szombatya* a genus to which it bears some resemblance. The apt specific name is that proposed by Dejean.

TAXA REMOVED FROM THE *MELANOTUS* GROUP

JONTHADOCERUS du Buysson

Jonthadocerus du Buysson, 1918: 109. Type species: *Jonthadocerus theryi* du Buysson, by monotypy.

Ionthadocerus du Buysson, 1924: 206. [Unjustified emendation.]

Jonthadocerus rufescens (Escalera)

Athous rufescens Escalera, 1914: 214. Holotype ♂, MOROCCO: Marrakech (*Escalera*) (Madrid Museum).

Jonthadocerus theryi du Buysson, 1918: 110. 2 syntypes, MOROCCO: Rabat (*Thery*) (MNHN, Fleutiaux collection) [examined]. [Synonymized by Cobos, 1958: 54.]

The description of *theryi* is based on four syntypes. One of those recorded above bears du Buysson's determination label with the word 'type'. The location of the other two is unknown. Binaghi (1939(xii): 180) refers to a cotype of *theryi* submitted by Peyerimhoff. Whether Peyerimhoff owned this specimen is also unknown. The du Buysson, Peyerimhoff and Thery collections are

in the MNHN, Paris. The claws, which are not mentioned in the description, are simple. Du Buysson assigned the genus to the Elaterini which, in his earlier work (1894: 15), includes all those genera in which the pronotosternal sutures are grooved only in the anterior portion of their length and the prosternum is distinctly lobed anteriorly. Schenkling's (1927: 287) inclusion of the genus in the Melanotinae is probably based on du Buysson's comment that *theryi* is reminiscent of certain *Melanotus* species.

Whether the specific synonymy is justified is open to doubt as Cobos's figure of *rufescens* does not show the carina on the posterior angle of the pronotum or the basal lateral incisions of the pronotum, both of which are present in *J. theryi*.

The genus was transferred to the Athouinae by Binaghi (1939(xii): 180), an action with which Cobos (1958: 54) declared himself in full agreement. While I am also of the opinion that there is no doubt that the genus does not belong to the *Melanotus* group I believe that further studies are required to elucidate its relationships. Preliminary investigations, undertaken in conjunction with the large DELTA-format data file (p. 38), which take into account such character states as the relative size and appearance of the 2nd, 3rd and 4th antennal segments, the presence of lateral incisions on the posterior margin of the pronotum and a polished inner hypomeral band, the truncate ventral aspect of the posterior angles of the prothorax and the emarginate posterior margin of the hypomeron, suggest a certain similarity to some *Ctenicera* group genera such as *Hypoganomorphus* Dolin *in* Dolin & Kurcheva (1975), but much work remains to be done before any conclusions can be reached. I suspect that considerable difficulties will be encountered in framing mutually exclusive, unambiguous character states describing the anterior portion of the head, the classic character used to separate the *Athous* group from the *Ctenicera* group of genera.

Penthelater umber (Bates) **comb. n.**

Melanotus umber Bates, 1866: 348. 1 ♀ syntype, TAIWAN: Melanotus umber Bates, Formosa [Bates] (BMNH) [examined].

The male is unknown. This species bears a close resemblance to *Penthelater plebejus* (Candèze) and in my opinion further studies may show that the two species are conspecific.

It is curious that Bates did not notice that the claws are simple. It must be assumed that he was misled by the *Melanotus*-like appearance of the species. The identity of the specimens identified as *Melanotus umber* Bates by Miwa (1929: 348; 1930: 63) and Ohira (1970b: 214) is unknown.

When Ohira (1970(ii)a: 9) erected *Penthelater* (type species *Ludius plebejus* Candeze) he assigned it to the subfamily Ampedinae (without subordinate group attribution), commenting that it was 'somewhat allied to *Homotechnes*'. Three years later Ohira (1973(iv): 22) transferred *Homotechnes* to the Hypnoidinae but did not mention *Penthelater*. Gurjeva (1974: 77) included *Penthelater* in the Megapenthini and in my opinion her action is fully justified. Not only does *plebejus* bear a strong general resemblance to Megapenthine species but the lateral lobes of the aedeagus resemble those of *melanocephalus* Fabricius, the type species of *Melanoxanthus*, which is included in the same tribe, in that each has a membranous apical extension (well figured by Gurjeva, 1973: 449, figs 22, 25).

Ohira's remark that *Penthelater* was 'somewhat allied to *Homotechnes*' is probably based on the fact that some years earlier Kishii & Ohira (1956: 76) had provisionally placed *plebejus* in *Homotechnes*. Ohira (1973(iv): 22) transferred *Homotechnes* to the Hypnoidinae and Stibick (1979(iii): 225) remarked that he considered it to be either a relict Hypnoidini or in the Ctenicerini. Examination of the ♀ syntype of the type species, *H. corymbitoides* Candèze, in the IRSNB, Brussels confirms Ohira's and Stibick's belief that the genus belongs to the *Hypnoidus* group of genera. How it differs from the six genera in Stibick's key (1957: 225) is outside the scope of this work.

SPECIES INCERTAE SEDIS

Elater brevicollis Herbst, 1806: 46, pl. 162, fig. 3.

Type material, U.S.A.: Baltimore (?MNHU). For over 100 workers seem to have had difficulty in interpreting this species. At the end of his description of *Cratonychus laticollis* Erichson (1841: 102) remarked that it was *perhaps* the same species as *brevicollis* Herbst ('Vielleicht ist dieser Káfer *El. brevicollis* Herbst . . .'). When Candèze (1860: 351) synonymized *laticollis* Erichson, 1841 with *fissilis* Say, 1839 he commented that according to Erichson *brevicollis might* be the same species. Say himself (1839: 183) remarked that ' I formerly marked it [*fissilis*] in my cabinet as the *brevicollis*, Herbst; . . .' but continues ' . . . but it can hardly be that species, as no notice is taken of the basal fissures [basal lateral incisions of the pronotum]'. Harold (1869(a): 1558) and Candèze (1891(v): 145) include *brevicollis* as a synonym of

fissilis but both indicated that the synonymy was provisional and required confirmation. Leng (1920: 174) lists *brevicollis* as though it was an undoubted synonym of *fissilis* and Schenkling (1927: 287) and Blackwelder (1974: 49) have followed suit. Curiously Quate & Thompson (1967), who synonymized *fissilis* Say, 1839 with *similis* Kirby, 1837, do not mention *brevicollis*.

The problem can be solved only by examination of the type material.

Elater fissilis Say, 1839

According to Quate & Thompson (1967: 15) the type material is lost. From the context it is clear that their interpretation of the species, which they synonymize with *similis* Kirby, 1837 (see p. 72), is based on material standing as *fissilis* in the various collections they examined. Examination of the specimens in the BMNH identified as *fissilis* by several different workers, including Candèze, has shown that although many are *similis*, quite a large number belong to other species. I believe this suggests that there is no real consensus of opinion concerning the identity of *fissilis* Say and consider that the wisest course is to treat it as a *species incertae sedis*.

Schenkling (1927: 287) records the date of publication of *fissilis* as 1836 but American cataloguers and workers all record the date as 1839. It is possible that the description appeared in 1836, see references p. 111, but until this date can be confirmed I believe the later date should be employed.

SPECIES INQUIRENDAE

Elater obscurus sensu Fabricius, 1775 nec Linnaeus, 1758.

This species appears for the first time in Fabricius's *Systemae entomologiae* (1775: 213) where it is presented with references to Linnaeus, 1761 and 1767 but with a diagnosis differing substantially from that of Linnaeus. I do not believe that the fact that Fabricius does not refer to Linnaeus, 1758 is of significance as he rarely cites that work. Fabricius included *obscurus* with the same diagnosis and references in his later works (1781, 1792, 1801) and as far as I can discover there is no reason to doubt that he intended to list the same species on each occasion.

By treating *obscurus* sensu Fabricius as a synonym of *Melanotus fulvipes* Herbst (1806) and including *obscurus* Linnaeus in *Agriotes,* Eschscholtz (1829: 32 & 34) indicated that he believed them to be different species and from that time workers seem to have been in agreement that *obscurus* sensu Fabricius and *obscurus* Linnaeus are not conspecific. *Elater obscurus* Linnaeus has remained in *Agriotes* to the present day but workers have differed in their interpretation of *obscurus* sensu Fabricius. Dejean (1833: 87) adopted Eschscholtz' synonymy with *fulvipes* Herbst but treated *obscurus* sensu Fabricius as the valid name. Erichson (1841: 96) stated that *obscurus* sensu Fabricius (and also of Olivier), but not *obscurus* Linnaeus, is *Cratonychus* [= *Melanotus*] *castanipes* Paykull. Blanchard (1845: 76) designated *Elater obscurus* sensu Fabricius as the type species of *Cratonychus* Dejean, 1833. For comments on this designation see p. 57. Du Buysson (1893: 35) treated *obscurus* sensu Fabricius (1775) and Olivier (1790) as a synonym of *Agriotes elongatus* (Marsham, 1802) [= *pilosellus* Schoenherr, 1817] and this synonymy is accepted by Leseigneur (1972: 319) in his recent work on the French Elateridae. The entries in the Schenkling catalogue serve only to increase the confusion. On page 274 *obscurus* [sensu] Olivier, 1790 and Fabricius, 1792 & 1801 (sic) is listed as a synonym of *Melanotus castanipes* Paykull and on page 453 *obscurus* [sensu] Fabricius, 1775, 1781, 1792 and 1801 and Olivier, 1790 (sic) appears as a synonym of *Agriotes pilosus* Panzer (1797) (= *pilosellus* Schoenherr, 1817, see Leseigneur, 1972: 319).

As there is so much uncertainty regarding the identity of *obscurus* sensu Fabricius I believe the species should be deleted from the catalogue and treated as a *species inquirenda*.

Elater obscurus sensu Olivier, 1790: 29, pl. 7, fig. 76 nec Linnaeus, 1758.

From the references listed by Olivier it is clear that he believed that the species depicted in his figure was *obscurus* of Linnaeus, Fabricius and other contemporary workers. Eschscholtz (1829: 32 & 34) was the first to draw attention to the fact that *obscurus* Linnaeus and *obscurus* sensu Fabricius are not conspecific (see *obscurus* sensu Fabricius above) and Erichson (1841: 95) expressed the opinion that the species depicted by Olivier was *obscurus* sensu Fabricius which he listed as a synonym of *Cratonychus* [= *Melanotus*] *castanipes* Paykull (1800). Schenkling (1927: 274) records *obscurus* sensu Olivier, 1890 as a synonym of *Melanotus castanipes* Paykull followed by references to Fabricius, 1792 & 1801 and later in the same work he (1927: 453) records the same references under *obscurus* sensu Fabricius, 1775 (see *obscurus* sensu Fabricius above) which is listed as a synonym of *Agriotes pilosus* Panzer.

In view of the uncertainty of the identity of *obscurus* sensu Olivier I believe that it should be deleted from the catalogue and treated as a *species inqirenda*.

APPENDIX

THE COMPUTER PROGRAMS USED IN THIS WORK

Three programs from a package of programs (Pankhurst, 1986; the 'Pankey package' of Dallwitz & Paine, 1986: 105) which process DELTA-format data files were used in the course of this work. A description of the DELTA (DEscription Language for TAxonomy) system for the concise representation and manipulation of taxonomic descriptions will be found in Dallwitz & Paine (1986). The programs are described in Pankhurst (1986).

1. The key-constructing program

The key-constructing program confers great benefits but also makes considerable demands upon the user. The benefits are obvious: much of the laborious and time-consuming work inseparable from the hand-construction of keys is eliminated and the ease with which the program can be instructed to alter the order in which characters are considered or to omit certain characters or items (taxa) altogether encourages the construction of alternative keys and, by so doing, testing cherished, but unfortunately all-to-often erroneous, theories concerning characters and character states. The time-honoured description of the pronotosternal suture ('double' or 'single' see p. 44) is a case in point. A moment's reflection shows that the concept is erroneous. The redefinition (#10, p. 94), though perhaps not perfect, has the merit of being a reasonably accurate description of what is seen and allows the inclusion of the dependent characters #28 and #29 (p. 95). The speed with which a key to a large number of items using all the available characters and character states is constructed naturally depends on the type of computer used, but is always a very small fraction of the time it would take to construct a similar key by hand.

The demands on the user arise from the fact that the accuracy of the keys and the convenience of their use is directly dependent upon the quality of the data and the wording of the character descriptions and states entered in the DELTA-format data file. The preparation of the character description section of the DELTA-format data file is an education in itself. Most workers will find submission to the stern but essential discipline of describing characters in terms of mutually exclusive character states a painful experience. They will find that difficulties cannot be glossed over by the use of such words as 'usually', 'rather' and 'more or less'. The program does allow two or more states for one character to be entered in the data file (the states are separated by a slash, e.g. p. 95, 002 28,1/2 which is translated as 'or' in translations into natural language), but naturally this renders the character less useful. There is no doubt that time and expertise invested in this part of the work reduces, though it cannot entirely prevent, the number of additions and changes which inevitably need to be made throughout the course of the work.

2. The interactive, online or expert identification program

This program was used to check the item descriptions section of the DELTA-format data file. This was done by 'identifying' the specimen from which the character states were originally drawn by interrogating the computer, the characters being chosen in a random order. Correct identification by the computer confirms that the data had been entered correctly. It is strongly recommended that people unconnected with the project and without specialized knowledge of the group in question carry out identifications. The results, though sometimes embarrassing to the key-constructer, can be extremely useful in that they draw attention to misleading or obscure wording.

3. The description-writing program

The program was used to prepare the generic diagnoses. Apart from the time saved the chief advantage of this program is that the character states are presented in the same order using the same wording for each taxon thereby making direct comparisons far easier.

Experience has shown that the form of the wording in the character descriptions section of the DELTA-format data filewhich produces the most acceptable plain language keys and is also suitable for use with the interactive identification programme does not necessarily produce the most euphonious generic diagnosis. The generic diagnoses have therefore been subject to more editing than the keys.

NOTES ON THE DELTA-FORMAT DATA FILE

Instructions and useful advice on the preparation of the various parts of the DELTA-format data file will be found in Pankhurst (1986), the literature accompanying the Pankhurst package and in Dallwitz & Paine (1986) and Watson (1984).

Specifications

This section, which appears at the beginning of the DELTA-format data file (p. 93), contains *directives* which describe the nature of the data (e.g. number of characters, number of states, number of items) and gives instructions to the processing program (e.g. the weighting of characters, the exclusion of characters and/or items and the format of the output, viz., 'indented or yoked' or 'parallel or bracketted' keys).

Character descriptions

Watson's maxim (1984: 90) that the quality of the character descriptions defines the standard of the work was born in mind throughout the preparation of this portion of the DELTA-format file. It must be admitted that it was the necessity of presenting the characters and their states in simple unambiguous terms which first led to the reappraisal of one of the principal classic characters, the appearance of the pronotosternal suture (see p. 91 above). The resulting discoveries are embodied in #10, 27, 28 & 29.

The characters selected are those previously used to define the genera in so far as it has proved possible to describe them in terms of two or more mutually exclusive states (#1, 6, 7, 11, 14, 15, 16, 17, 19, 21, 23 & 27) and five new or previously disregarded characters (#10, 13, 26, 28 & 29) which I believe to be of value at generic rank. Thirteen additional characters (#2, 3, 4, 5, 8, 9, 12, 18, 20, 22, 24, 30 & 31), which were found to be very useful when the data file was used with the interactive identification program, are also included. #25, originally the last, has been used to record various items of information about the taxon which can, if required, be used in the preparation of descriptions. If it was decided that it would be useful to subdivide the group on the basis of distribution (or any one of the categories included under #25) this could be done by assigning each feature a character number and giving the appropriate instructions in the specifications section. The key to species (p. 98) resulting from the use of 29 characters (#18, whose states are at present too poorly defined to be of any value, and #25 (see above) are excluded) illustrates the large number of combinations in which the character states appear. The key (p. 100) produced when the number of characters is reduced to the seven (#7, 10, 19, 21, 26, 27 & 29) believed to be of value at generic rank, is the numerical version of the edited plain language key on p. 53. As can be seen, synonyms are listed in the order in which they appear in the data file. For both keys, #7, 10 & 26 which are easy to observe and, with the possible exception of the last (see p. 46), believed to be constant, have been weighted so that they appear at the beginning of the key.

Item (taxon) descriptions

The species selected for inclusion in the key are the type species of genera and subgenera (for rapid recognition the generic name is entered in upper case) and species included in these taxa (lower case with initial capital) which display different combinations of character states. The names used are those in current use before the publication of this paper. I have little doubt that there are species, both described and undescribed, which possess yet more combinations of the character states listed on pp. 93–95. The discovery of a new combination or new combinations of the states of #7, 10, 19, 21, 26, 27 & 29 could necessitate either the erection of a new genus or the synonymy of extant genera, depending on the assessment of the value of the characters at generic rank. From experience of the family I believe that the character states of #19 (appearance of the 3rd tarsal segment), #21 (presence or absence of large punctures on the last visible abdominal sternite) and possibly also #26 (ventral aspect of the posterior angles of the pronotum, whether pointed or truncate) and #27 (whether the pronotosternal suture lies at the base of a groove) may prove to be less constant than they appear at present.

THE *MELANOTUS* GROUP DELTA-FORMAT DATA FILE

The programs do not accept type-setting marks in the data file. However, for the sake of clarity, italics and bold-face are used in the file reproduced below.

Certain symbols, such as a slash (/), cannot be used in the text. Where necessary they are replaced by other symbols, whose use is not restricted (e.g. and-or = and/or).

Information enclosed in square brackets is for information only and is not part of the file.

The key program will not accept the data-file as presented here. Character descriptions are limited to one line ending in a slash. See Dallwitz & Paine (1986) for rules governing character state entries.

[Specifications]
*HEADING *Melanotus* group of genera, datafile, S42i31c, xii.1988/

[Appears as title of the key. The abbreviation which indicates the contents (Specifications, 42 items, 31 characters), also serves as the name of the file.]
*COMMENT for key to 42 items using 29 characters/

[*or* for key to 42 items using 7 characters (key to genera p. 53 & 100): 7 10 19 21 26 27 29. An *aide-mémoire*, for data not asociated with a particular item, character or character state],
*KEY OPTIONS OLDKEY NOINDENT PARTIAL/

['Oldkey' specifies type of key, the default is an 'indented' or 'yoked' key. 'Partial' overrides the default assumption that all taxa are supposed to be distinct from one another and that you will not want to proceed unless they are. Without this instruction the program will not produce the kind of key (p. 98) in which one or both halves of a couplet lead to two or more taxa.]
*NUMBER OF CHARACTERS 31
*MAXIMUM NUMBER OF STATES 5
*MAXIMUM NUMBER OF ITEMS 42
*CHARACTER TYPES 25,TE

[Five main types are recognized, unordered multistate (UM), ordered multistate (OM) which can further be specified as exclusive (EUM & EOM), integer numeric (IN), real numeric (RN) and text (TE). The default is unordered multistate.
*NUMBERS OF STATES 9,4 11,3 12,3 14,3 15,3 19,3 20,4 23,5 30,3
*EXCLUDE CHARACTERS 18 25

[*or* for key to 42 items using 7 characters (key to genera p. 53 & 100): 1 2 3 4 5 6 8 9 11 12 13 14 15 16 17 18 20 22 23 24 25 28 30 31]
*CHARACTER WEIGHTS 7,5 10,5 26,5

[The default is 1. The weight chosen here is arbitrary, and the program chooses between the 3 characters. If the weights are different the program will follow the sequence given, provided it is possible to construct a key.]
*CHARACTER DESCRIPTIONS

[Each character description consists of a feature description (e.g. parantennal pits, pronotosternal suture) followed, in the case of multistate characters, by a character state description (e.g. present, absent, sharp, truncate).

[Sentences within sharp brackets are comments. They are ignored by the key-constructing program but appear in the interactive program where they are useful in indicating the nature of a character where this is not immediately obvious from the feature description, e.g. #4. Parantennal pits <presence or absence> and #12. Parantennal pits <shape>.]

[The order of the character descriptions is not entirely logical. This is due to the changes and additions which became necessary in the course of the work. With the program CONFOR (Dallwitz & Paine, 1986: 26, 3.5.8) the character and item descriptions can be rapidly and accurately re-ordered. Unfortunately this program could not be used on the computer employed in the course of this work.]

#1. <Antennae, relative length of the second and third segments>/
1. 2nd and 3rd antennal segments equal or subequal in length, the 3rd shorter than the 4th/
2. 3rd antennal segment almost twice as long as the 2nd and equal to at least three-quarters the length of the 4th/
#2. <Antennae, presence or absence of carinae>/
1. one or both flat faces of the 4th and some or all the following antennal segments with a longitudinal carina/
2. flat faces of antennal segments without a longitudinal carina/
#3. Frons (appearance, lateral and anterior aspect)/
1. projecting, not depressed in the mid line, the mid point of the anterior margin does not lie below the level of the posterior lateral angle of the frons (Figs 2, 6, 7, 8, 9)/
2. depressed in the mid line, the mid point of the anterior margin lies below the level of the posterior lateral angle of the frons (Figs 1, 3, 4, 5)/
#4. Parantennal pits <presence or absence, for shape see #12>/
1. present (Fig. 6)/
2. absent (Figs 7-9)/
#5. Mandibles <presence or absence of a basal pit>/
1. with a basal pit/
2. without a basal pit/
#6. Lateral margins of prothorax <whether carinate laterally>/
1. with a carina extending from the posterior to the anterior angle/
2. without a carina extending from the posterior to the anterior angle/
#7. Pronotum <presence or absence of basal lateral incisions>/
1. with basal lateral incisions (Fig. 10)/
2. without basal lateral incisions (Fig. 11)/

#8. Posterior angles of the pronotum <number of carinae on>/
1. unicarinate/
2. bicarinate/
#9. Scutellum <appearance in profile>/
1. steeply declivous to prescutum, anterior margin straight with a median notch/
2. steeply declivous to prescutum, anterior margin emarginate or very feebly notched/
3. steeply declivous to prescutum, anterior margin straight or slightly arcuate/
4. gradually declivous to prescutum, anterior margin straight, disk with a median longitudinal groove/
#10. Inner margin of the hypomeron <whether bordered>/
1. with a well-defined, narrow, completely, or almost completely, impunctate border separated from the rest of the hypomeron by a distinct groove or raised above it; if the posterior portion of the border is not well-defined and/or punctured (e.g. *M. pulvereus* Candèze), then the anterior portion slopes meso-dorsad and is concave (Figs 18, 18a, 19,)/
2. without a well-defined narrow impunctate border; if the portion of the hypomeron adjacent to the pronotosternal suture is impunctate the impunctate area is not separated from the rest of the hypomeron by a distinct groove or raised above it and does not slope meso-dorsad in the anterior third of its length (Figs 20, 21)/
#11. Apex of each elytron <outline>/
1. simple, together the elytra form a rounded point or each one may be very feebly rounded, truncate or emarginate, the emargination limited to the area between the suture and the prolongation of the line of the 3rd elytral stria/
2. distinctly emarginate, the emargination extending from the suture to the prolongation of the line of the 5th elytral stria or beyond/
3. crenate/
#12. Parantennal pits <shape>/
1. round, deep/
2. round or irregular, shallow/
3. oval or crescent-shaped/
#13. <structure of the margin of mesocoxal cavity>/
1. mesepisternum does not form part of the margin of the mesocoxal cavity (Figs 23–25)/
2. mesepisternum forms part of the margin of the mesocoxal cavity (Fig. 26)/
#14. Ventral face of mucro <in profile>/
1. horizontal for at least the anterior half of its length (Figs 14, 16, 17)/
2. sloping posteriad-dorsad (Fig. 13)/
3. angled (Fig. 15)/
#15. Margin of mesosternal groove <in profile>/
1. slopes anteriad (Fig. 26)/
2. distinctly angled, posterior portion horizontal (Fig. 14)/
3. feebly angled, posterior portion sloping dorso-anteriad (Fig. 25)/
#16. Suture between mesosternum and metasternum <visibility of>/
1. indistinct or apparently absent, its position marked by a fine, often very indistinct, line in the chitin/
2. distinct; it may lie at the base of a groove/
#17. Posterior free margin of the metacoxal plate <outline of>/
1. with a distinct tooth within the inner half of its length (Figs 33, 34, 35, 37)/
2. without a distinct tooth; a feeble rounded projection may be present within the inner half of its length (Figs 32, 36)/
#18. <Anterior and mid femora and tibiae, shape>/
1. anterior and mid femora and tibiae distinctly compressed laterally (Fig. 39)/
2. anterior and mid femora and tibiae not distinctly compressed (Fig. 38)/
#19. Third tarsal segment <appearance of>/
1. dorso-ventrally depressed with the ventral prolongation extending beneath the entire length of the 4th segment/
2. simple, vertically or obliquely truncate distally, if a small ventral prolongation or lobe is present it does not extend beneath the entire length of the 4th segment (Figs 38, 39)/
3. dorsoventrally depressed, the ventral prolongation does not extend beneath the entire length of 4th segment (Figs 40, 41)/
#20. Apex of the last visible abdominal sternite <outline of>/
1. with a small pointed projection on either side near the apex (Fig. 30)/
2. with a shallow emargination on either side of the apex (Fig. 29)/
3. simple, bluntly arcuate without projections or emarginations (Fig. 27/
4. truncate or feebly arcuate (Fig. 28)/
#21. Ventral surface of the last visible abdominal sternite <presence of punctures>/
1. with two or more large punctures or pits near the apex (Fig. 31)/
2. without large punctures or pits near the apex (Figs 27-30)/
#22. Abdominal tergites <degree of sclerotization>/
1. strongly sclerotized, usually dark in colour and with large distinct punctures, the contents of the abdomen not visible through them, not wrinkled in dead specimens/
2. not strongly sclerotized, thin, usually pale in

colour without large distinct punctures, the contents of the abdomen often visible through them, almost always wrinkled in dead specimens/

#23. Lateral lobes of the aedeagus <shape of apex>/

1. each with an apical barb/
2. each with an apical and basal barb/
3. without apical or basal barbs/
4. widened but not barbed apically/
5. without a distinct apical barb in dorsal view, but with an apical barb-shaped support in ventral view/

#24. The median lobe of the aedeagus projects beyond the lateral lobes by <length>/

1. a distance considerably greater than the length of the barbs/
2. a distance equal to or only very slightly longer than the length of the barbs/

#25. <(1)genus established by (2)type species designated by (3)original combination of type species (4)valid name of type species (5)distribution (6)which sex unknown [transferred to taxon name line] (7)species with similar character states (8)other comment>/

#26. In ventral view the posterior angles of the prothorax <shape>/

1. terminate in a point (Figs 11a, 12)/
2. are truncate at the apex (Fig. 10a)/

#27. Pronotosternal suture <position>/

1. situated at or near the base of an impunctate groove which attains or almost attains the anterior margin of the anterior coxal cavity; the sides of the groove are formed by the steeply declivous, and often concave, inner border of the hypomeron and the impunctate lateral margin of the prosternum (Fig. 19)/
2. not situated at the base of a groove; if the inner border of the hypomeron and the lateral margin of the prosternum are steeply inclined towards one another the groove or channel so formed does not extend beyond the anterior two-thirds of the length of the suture and the inner wall of the groove, formed by the prosternum, is punctured (Figs 18, 18a, 20–22)/

#28. The inner border of the hypomeron <whether sloping meso-dorsad>/

1. slopes meso-dorsad within the anterior two-thirds of its length to form a shallow channel or groove <'suture open anteriorly' or similar phrase of previous workers> (Figs 18, 18a)/
2. does not slope meso-dorsad within the anterior two-thirds of its length <'suture closed anteriorly' or similar phrase of previous workers> (Figs 20–22)/

#29. The inner border of the hypomeron <length>/

1. extends beyond the anterior divergence point of the hypomeron and prosternum forming the anterior free border of the hypomeron which slopes meso-dorsad and may be concave (Figs 18, 18a)/
2. does not extend beyond anterior divergence point of the hypomeron and prosternum, or if it is prolonged anteriorly it becomes much narrower and lies in the same plane as the adjoining portion of the hypomeron (Figs 20–22)/

#30. Nasale <appearance>/

1. simple, without a distinct median raised area (Figs 3–5)/
2. with a median raised area with or without cariniform lateral margins, if cariniform margins are present there may be a shallow depression between them (Figs 7, 8)/
3. with 2 confluent carinae forming an inverted 'Y' (Fig. 9)/

#31. Valves of ovipositor <appearance>/

1. delicate/
2. stout/

*DEPENDENT CHARACTERS 4,2:12 10,2:27–29 23,3:24 27,1:28

[i.e if #4 has state 2 then #12 is impossible and if #10 has state 2 #27 to 29 are impossible.]

*ITEM DESCRIPTIONS

[For conventions used see p. 92.]

[The order in which the species are listed is of no significance. Species were entered according to availability of material and personal preference. Numbers commence in 0 or 00 in order to distinguish them from those of the character descriptions when the computer's 'find' facility is used.]

['/' separating character states indicates 'or'. An inapplicable character state (i.e. of a dependent character) is entered as '-'.]

#001. *CRATONYCHUS obscurus* <[sensu] Fabricius, 1775, see p. 90>/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,2/3 10,1 11,1 12,–13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(a)Dejean, 1833: 87 (2)Blanchard, 1845: 76 (3)*Elater* (5)W. Pal. (8)data from specimens determined by Dejean> 26,2 27,2 28,1 29,1 30,1 31,1

#002. *CREMNOSTETHUS nigricollis* Schwarz, 1902/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,–13,1 14,3 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(1)Schwarz, 1902(i)a: 197 (3) Hyslop, 1921: 630 (5)Assam> 26,2 27,2 28,1/2<individ. var.?> 29,1 30,1 31,2<moderate>

#003. *DODECACTENUS staudingeri* Candèze, 1889/
1,2 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,2 10,1 11,1 12,–13,1 14,1 15,2 16,1 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,1 25,<(1)Candèze, 1889: 102(36) (2) monobasic (5)C. America> 26,2 27,2 28,1 29,1 30,1 31,1

#004. *Dodecactenus guatemalensis* Champion, 1896/
1,1 2,2 3,2 4,1<feeble> 5,2 6,1 7,1 8,2 9,2 10,1 11,1 12,2 13,1 14,1 15,2 16,1 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,1 25,<(5)C. America> 26,2 27,2 28,1<short> 29,1 30,2 31,1

#005. *NEOFLEUTIAUXIA fruhstorferi* Platia, 1986 <♀ unknown>/
1,1 2,1 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,2 12,– 13,1 14,2 15,3 16,2 17,2 18,2 19,1 20,3 21,2 22,2 23,1 24,1 25,<(1)Platia, 1986: 1 (2)original designation (5)Celebes (6)♀ unknown> 26,1 27,– 28,– 29,– 30,1

#006. *MELANOTOPSIS cete* (Candèze, 1860)/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,1 15,2 16,2 17,2 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,<(1)Lewis, 1894: 192 (2)Sharp, 1894: 148 (3)*Melanotus* (5)Japan> 26,2 27,2 28,1 29,1 30,1 31,2<moderate>

#007. *MELANOTUS* fulvipes (Herbst, 1806)/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,2/3 10,1 11,1 12,– 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(1)Eschscholtz, 1829: 32; (2) Westwood, 1838: 26 (3)*Elater* (4)*Melanotus villosus* (Geoffroy *in* Foucroy) (5)W. palearctic> 26,2 27,2 28,1 29,1 30,1 31,1

#008. *Melanotus albernus* Candèze, 1888/
1,1 2,2 3,1 4,1<v. small> 5,2 6,1 7,1 8,1 9,1 10,1 11,1 12,2 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,<(5) Tenasserim> 26,2 27,2 28,1 29,1 30,1 31,1

#009. *Melanotus cladestinus* (Erichson, 1841) <♀ unknown>/
1,1 2,2 3,2 4,1<v. indistinct> 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,2<shallow, irregular; Q & T obsolescent> 13,1 14,2 15,1 16,2 17,2<with rounded projection> 18,2 19,2 20,3 21,2 22,1 23,3 24,– 25,<(5) U.S.A. (6)♀ unknown> 26,2 27,2 28,1 29,1 30,1

#010. *Melanotus cuneolus* Candèze, 1860/
1,1 2,2 3,1 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,2 15,2 16,2 17,2 18,1<slight> 19,2 20,2 21,2 22,2 23,1 24,1 25,<(5)Java> 26,2 27,2 28,1 29,1 30,1 31,2<moderate>

#011. *Melanotus depressus* (Melsheimer, 1845)/
1,1 2,2 3,2 4,1 5,1 6,1 7,1 8,1 9,3 10,1 11,1 12,3 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,3 24,– 25,<(5)U.S.A.> 26,2 27,2 28,1 29,1 30,2<slight> 31,1

#012. *Melanotus guambatae* Van Zwaluwenburg, 1933/
1,1 2,2 3,1 4,1 5,2 6,1 7,1 8,1 9,1 10,1 11,1 12,1 13,1 14,2 15,3 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,2 24,2 25,<(5)Solomon Is> 26,2 27,2 28,1 29,1 30,2 31,1

#013. *ANCHISZOMBATYA porrectifrons* gen. & sp. n./
1,1 2,1<indistinct> 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,1 11,2 12,– 13,1 14,2 15,2 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,1 25,<(1)described p. 00 (2)monobasic (5)Java> 24,2 26,1 27,2 28,2 29,2 30,1 31,2

#014. *Melanotus hapatesus* Candèze, 1880/
1,1 2,2 3,2 4,1 5,2 6,1 7,1 8,1 9,2/3 10,1 11,1 12,1 13,1 14,2 15,3 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Sumatra (7)*hirtellus* Candèze, Java> 26,2 27,2 28,1 29,1 30,2 31,1

#015. *Melanotus mouldsi* Calder, 1983/
1,1 2,2 3,2<with impression> 4,2 5,2 6,1 7,1 8,1 9,1 10,1 11,1 12,– 13,1 14,1 15,2 16,2 17,2 18,1 19,2 20,3 21,2 22,2 23,5 24,1 25,<(5)Australia> 26,2 27,2 28,1 29,1 30,1 31,1<?borderline>

#016. *Melanotus similis* (Kirby, 1837)/
1,1 2,2 3,1 4,1 5,2 6,1 7,1 8,1/2<Q&T 'often 2'> 9,3 10,1 11,1 12,3 13,1 14,2 15,1 16,2 17,2 18,2<slight> 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Canada> 26,2 27,2 28,1 29,1 30,2 31,1

#017. *METRIAULACUS nigrolaterus* Schwarz, 1902 <♀ unknown>/
1,1 2,2 3,1 4,2 5,2 6,1 7,1 8,1 9,1 10,1 11,1 12,– 13,1 14,2 15,3 16,2 17,2 18,1<slight> 19,2 20,3 21,2 22,2 23,1 24,2 25,<(1)Schwarz, 1902(i)a: 198 (2)monobasic (5)Borneo (6)♀ unknown> 26,2 27,1 28,– 29,1 30,1 31,2<moderate>

#018. *Metriaulacus gobius* (Candèze, 1860)/
1,1 2,2 3,1 4,2 5,2 6,1 7,1 8,2 9,1 10,1 11,1 12,– 13,1 14,2 15,3 16,2 17,2 18,1<slight> 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Java> 26,2 27,1 28,– 29,1 30,1 31,2<moderate>

#019. *NATOMELUS arcanus* Dolin, 1979 (fm des. & fig., ♀ unknown)/
1,1 6,1 7,1 8,1 9,3 10,1<from interpretation of description> 11,1 17,1 19,2 20,3 21,2 23,3 24,– 25,<(1)Dolin, 1979: 71 (2)monobasic (5) U.S.S.R. (6)♀ unknown> 27,2<from interpretation of description> 28,1<from interpretation of description>

#020. *NEODIPLOCONUS peregrinus* (Candèze, 1860)/
1,1 2,1 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,2 12,– 13,1 14,1 15,3 16,2 17,1 18,2 19,2 20,3 21,2<dark but unpunctured> 22,2 23,1 24,1 25,<(1)Hyslop, 1921: 658 (2)Hyslop, 1921: 658 (3)*Diploconus* (5)Borneo> 26,1 27,– 28,– 29,– 30,2 31,1

#021. *Neodiploconus ciprinus* (Candèze, 1865)/
1,1 2,1 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1 12,– 13,1 14,2 15,3 16,2 17,1 18,2 19,2 20,1 21,2 22,2 23,1 24,1 25,<(5)Philippines> 26,1 27,– 28,– 29,– 30,2 31,1

#022. *Neodiploconus homostictus* (Candèze, 1860)/
1,1 2,2 3,1 4,2 5,2 6,1 7,2 8,1 9,3 10,2 11,1<ogee> 12,– 13,2 14,2 15,1 16,2 17,1<feeble> 18,2 19,2 20,3 21,2 22,2 23,1 24,1 25,<(5)Borneo> 26,1 27,– 28,– 29,– 30,2 31,1

#023. *Neodiploconus (PLOCONIDES) spiloderus* (Candèze, 1864)/
1,1 2,1 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1 12,– 13,1 14,2 15,3 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,1 24,1 25,<(1)Fleutiaux, 1933: 208 (2)original designation (3)*Diploconus* (5)Malaya> 26,1 27,– 28,– 29,– 30,2 31,1

#024. *PRIOPUS frontalis* Castelnau, 1840 <♀ unknown>/
1,1 2,2 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1<ogee> 12,– 13,1<?borderline> 14,2 15,3 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,1 24,1<slightly> 25,< (1)Castelnau, 1840: 251 (2)Hyslop, 1921: 666 (5)Java (6)♀ unknown (7)*N. angulatus* (Candèze), *ardjoenicus* (Candèze), *plagiatus* (Candèze), *nigricornis* (Candèze), *rubidus* (Erichson)> 26,1 27,– 28,– 29,– 30,1

#025. *Neodiploconus prominens* (Erichson, 1841)/
1,1 2,1 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,2 12,– 13,1 14,2<feebly> 15,1 16,2 17,1<rounded> 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Java (7)*N. porrectus* (Erichson), *carneus* Candèze, *enganensis* Candèze, *ambustus* Candèze> 26,1 27,– 28,– 29,– 30,3 31,2

#026. *PSELLIS promiscua* (Erichson, 1841)/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,2 15,3 16,2 17,2 18,1 19,3 20,3 21,2 22,2 23,1 24,2 25,<(1)(Candèze, 1860: 289 (2) monobasic (3)*Cratonychus* (5)Mauritius> 26,2 27,2 28,1 29,1 30,1 31,1

#027. *Thaumastiellus (PULCHRONOTUS) ornatus* (Candèze, 1891)/
1,1 2,2 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1 12,– 13,1<borderline> 14,2 15,3 16,2 17,2 18,2 19,2 20,3 21,2 22,1 23,1 24,1 25,<(1)Fleutiaux, 1933: 206 (2)original designation (3)*Diploconus* (5)Carin Cheba> 26,1 27,– 28,– 29,– 30,1 31,1

#028. *SPHENISCOSOMUS cuneiformis* (Baudi, 1871)/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,1 15,2 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(1)Schwarz, 1892(iv): 132 (2) Hyslop, 1921: 670 (3)*Melanotus* (4)*sulcicollis* M & G (5)Cyprus> 26,2 27,2 28,1 29,1 30,1 31,2<moderate>

#029. *SZOMBATYA formosana* (Szombathy, 1910) <♀ chars. uncert.>/
1,1 2,2 3,1 4,1 5,2 6,1 7,2 8,1 9,1<and grooved> 10,1 11,1 12,1 13,1 14,2 15,3 16,2 17,2 18,2 19,2<obliquely truncate distally> 20,3 21,1 22,2 23,1 24,2 25,<(1)Platia, 1986: 2(2)monobaic (3)*Psellis* (5)Taiwan> 26,2 27,2 28,1 29,1 30,2 31,1<from undetermined ♀, see p. 86>

#030. *THAUMASTIELLUS bioculatus* Schwarz, 1902 <♀ unknown>/
1,1 2,2 3,1 4,2 5,2 6,2 7,2 8,2 9,3 10,2 11,1 12,– 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,1 25,<(1)Schwarz, 1902(i)b: 336 (2)monobasic (5)Tonkin (6) ♀ unknown> 26,1 27,– 28,– 29,– 30,1 31,2

#031. *TENALOMUS fulvipennis* Fleutiaux, 1933 <data inc. ♀ unk.>/1,1 6,1 7,1 8,1 9,3 10,1 11,2 13,1 14,1 19,2 21,2 25,<(1)Fleutiaux, 1933: 234 (2)monobasic (5)Tonkin (6)♀ unknown> (8) data incomplete) 26,2 27,2 28,1 29,1<assumed>

#032. *Melanotus (KENSAKULUS) invectitus* Candèze, 1865/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,2 15,3 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(1)Chujo & Ohira, 1965: 24 (2)monobasic (5)Japan> 26,2 27,2 28,1 29,1 30,1 31,1

#033. *Melanotus annosus* Candèze, 1865/
1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,3 24,– 25,<(5)Japan (7)*carinatus* Candeze, *labidus* Candeze> 26,2 27,2 28,1 29,1 30,1 31,2<moderate>

#034. *Melanotus puberulus* (Erichson, 1841)/
1,1 2,2 3,1 4,1 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,3<small, dissimilar> 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,3 24,– 25,<(5) Java (7)*candezei* Schwarz, *dispunctatus* Candeze, *malaisei* Fleutiaux, *mendiculus* Candeze> 26,2 27,2 28,1 29,1 30,1 31,1

#035. *Melanotus carinifer* Champion, 1896 <♀ unknown>/
1,1 2,2 3,2 4,1 5,1 6,1 7,1 8,1/2<indistinct> 9,3 10,1 11,1 12,2<shallow> 13,1 14,2 15,2 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,4 24,2 25,<(5) Mexico (6)♀ unknown> 26,2 27,2 28,1 29,1 30,2<moderate>

#036. *Melanotus restrictus* Candèze, 1865/
1,1 2,2 3,2 4,1 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,3 13,1 14,1 15,2 16,2 17,2 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,<(5)Japan> 26,2 27,2 28,1 29,1 30,1 31,1

#037. *Neodiploconus leveri* van Zwaluwenburg, 1940 <♀ unknown>/
1,1 2,1 3,2 4,2 5,2 6,1 7,2 8,1 9,3 10,2 11,1 12,– 13,1<borderline> 14,2 15,3 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,1 24,1 25,<(5)Solomon Is (6)♀ unknown> 26,1 27,– 28,– 27,– 30,1

#038. *Neodiploconus boninensis* van Zwaluwenburg, 1957/
1,1 2,2 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1 12,– 13,1<borderline> 14,2 15,3<very feeble> 16,2 17,1 18,2 19,2 20,3 21,2 22,2 23,1<from figure> 24,1<from figure> 25,<(5)Bonin Is> 26,2 27,– 28,– 29,– 30,1 31,1

#039. *Melanotus lewisi* Schenkling, 1927/
1,1 2,2 3,1 4,1 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,3 13,1 14,1 15,1 16,2 17,2 18,1 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Japan (7)*legatus*

Candèze> 26,2 27,2 28,1 29,1 30,1 31,2<?, broken>

#040. *Melanotus umbilicatus* (Gyllenhal, 1817)/ 1,1 2,2 3,2 4,1 5,2 6,1 7,1 8,1 9,4 10,1 11,1 12,1 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,3 21,2 22,2 23,1 24,2 25,<(5)Africa> 26,2 27,2 28,1 29,1 30,2 31,1

#041. *Neodiploconus (Ploconides) nigerrimus* (Fleutiaux, 1903)/ 1,1 2,2 3,1 4,2 5,2 6,1 7,2 8,2 9,3 10,2 11,1 12,– 13,1<borderline> 14,2 15,1 16,2 17,1 18,2 19,2 20,3 21,2 22,1 23,1 24,2 25,<(5)Tonkin> 26,1 27,– 28,– 29,– 30,1 31,1

#042. *Melanotus brunnipes* (Germar, 1824)/ 1,1 2,2 3,2 4,2 5,2 6,1 7,1 8,1 9,3 10,1 11,1 12,– 13,1 14,2 15,1 16,2 17,2 18,2 19,2 20,4 21,2 22,1<pale> 23,1 24,2 25,<(5)W. Palaearctic> 26,2 27,2 28,1 29,1 30,1 31,1

*END

NUMERICAL-FORMAT KEY TO 42 TAXA USING 29 CHARACTERS

This key was made using the directive on p. 93.

It will be noticed that two genera appear four times. *Natomelus* keys out at couplets 22, 26, 36 and 40 and *Tenalomus* at couplets 19, 34, 39 & 43. This is because the default in the version (key3m2) of the Pankhurst key-constructing program used in this work is to treat unknown characters as variable. Unknown characters are treated as variable only if the program cannot construct a key separating all the items without doing so, and the number of characters used is kept to a minimum. In this case the program has assumed (couplets 17 & 31) that the two species possess both states of #3 (whether the frons is projecting or depressed) and #4 (presence or absence of parantennal pits) and that the former possesses (couplet 20) both states of #31 (ovipositor valves stout or delicate) and the latter (couplet 38) both states of #17 (outline of the posterior free margin of the metacoxal plate).

1 7,2(Fig. 11) 2

– 7,1(Fig. 10) 15

2 10,1(Figs 18, 18a, 19) 3

– 10,2(Figs 20, 21) 4

3 26,1(as Fig. 11a) 2,1 4,2 8,2 9,3 11,2 15,2 17,1(Fig. 37) 21,2(as Fig. 27) 28,2(Fig. 22) 29,2(Fig. 22) 30,1 31,2
... 013. ***ANCHISZOMBATYA porrectifrons*** gen. n & sp. n.

– 26,2(as Fig. 10a) 2,2 4,1 8,1 9,1 11,1 15,3 17,2(as Figs 32, 36) 21,1(Fig. 31) 28,1(as Figs 18, 18a) 29,1(as Figs 18, 18a) 30,2 31,1
..... 029. ***SZOMBATYA formosana*** (Szombathy, 1910)

4 26,2(as Fig. 10a)
.... 038. ***Neodiploconus boninensis*** van Zwaluwenburg, 1957

– 26,1(Fig. 11a, 12) 5

5 2,2 6

– 2,1 10

6 15,3 7

– 15,1 8

7 17,1(as Figs 33, 34, 35, 37) 22,2
..... 024. ***PRIOPUS frontalis*** Castelnau, 1840

– 17,2(Fig. 36) 22,1
..... 027. ***Thaumastiellus (PULCHRONOTUS) ornatus*** (Candèze, 1891)

8 6,2 17,2(as Fig. 36) 31,2
... 030. ***THAUMASTIELLUS bioculatus*** Schwarz, 1902

– 6,1 17,1(Figs 34, 35, 37) 31,1 9

9 8,1 13,2(Fig. 26) 22,2 24,1 30,2
.. 022. ***Neodiploconus homostictus*** (Candèze, 1860)

– 8,2, 13,1(as Fig. 25) 22,1 24,2 30,1
..... 041. ***Neodiploconus (Ploconides) nigerrimus*** (Fleutiaux, 1900)

10 11,2 11

– 11,1 13

11 14,1 30,2 .... 020. ***NEODIPLOCONUS peregrinus*** (Candèze, 1860)

– 14,2 30,1 or 30,3 12

12 15,1 17,1(as Figs 33–35, 37) 19,2(as Figs 38, 39) 24,2 30,3
... 025. ***Neodiploconus prominens*** (Erichson, 1841)

– 15,3 17,2(as Fig. 36) 19,1 24,1 30,1
.... 005. ***NEOFLEUTIAUXIA fruhstorferi*** (Platia, 1986)

13 3,2(as Fig. 1) 8,1 30,1
.... 037. ***Neodiploconus leveri*** van Zwaluwenburg, 1940

– 3,1(as Figs 2, 6, 7, 8, 9) 8,2 30,2 14

14 20,1(Fig. 30) ..... 021. ***Neodiploconus ciprinus*** (Candèze, 1865)

– 20,3(as Fig. 27)
... 023. ***Neodiploconus (PLOCONIDES) spiloderus*** (Candèze, 1864)

15 27,1 16

– 27,2 17

16 8,1

.... 017. ***METRIAULACUS nigrolaterus*** Schwarz, 1902

– 8,2 ..... 018. ***Metriaulacus gobius*** (Candèze, 1860)

17 4,2 18

– 4,1 31

18 1,2 ..... 003. ***DODECACTENUS staudingeri*** Candèze, 1889

– 1,1 19

19 11,2 .. 031. ***Melanotus (TENALOMUS) fulvipennis*** Fleutiaux, 1933 (data incomplete)

– 11,1 20

20 31,2 21

– 31,1 26

21 23,3 22

– 23,1 23

22 17,1(as Figs 33, 34, 35 37) .... 019. ***NATOMELUS arcanus*** Dolin, 1979 (from description and figures)

– 17,2(as Figs 32, 36) ..... 033. ***Melanotus annosus*** Candèze, 1865

23 3,1(as Figs 2, 6) 14,2, 20,2(Fig. 29) 24,1 ..... 010. ***Melanotus cuneolus*** Candèze, 1860

– 3,2(Figs 1, 3, 4, 5) 14,1 or 14,3, 20,3(Fig. 27) 24,2 24

24 14,3, 15,1 ... 002. ***CREMNOSTETHUS nigricollis*** Schwarz, 1901

– 14,1 15,2 25

25 22,1 .. 006. ***MELANOTOPSIS cete*** (Candèze, 1860)

– 22,2 ..... 028. ***SPHENISCOSOMUS cuneiformis*** (Baudi, 1871)

26 17,1(as Figs 33, 34, 35, 37), 23,3 .... 019. ***NATOMELUS arcanus*** Dolin, 1979 (from description and figures)

– 17,2(Figs 32, 36), 23,1 or 23,5 27

27 14,1, 9,1, 15,2, 23,5, 24,1 . 015. ***Melanotus mouldsi*** Calder, 1983

– 14,2, 9,2 or 9,3, 15,1 or 15,3, 23,1, 24,2 28

28 15,3 29

– 15,1 30

29 19,2(as Figs 38, 39) ..... 032. ***Melanotus (KENSAKULUS) invectitus*** Candèze, 1864

– 19,3(Figs 40, 41) ..... 026. ***PSELLIS promiscua*** (Erichson, 1841)

30 20,4(Fig. 28) 22,1 ..... 042. ***Melanotus brunnipes*** (Germar, 1824)

– 20,3(Fig. 27) 22,2 .. 001. ***CRATONYCHUS obscurus*** (sensu Fabricius, 1775) 007. ***MELANOTUS fulvipes*** (Herbst, 1806)

31 3,1(Figs 2, 6, 7, 8, 9) 32

– 3,2(Figs 1, 3, 4, 5) 38

32 9,1 33

– 9,3 34

33 12,1 15,3 22,2 23,2 30,2 .. 012. ***Melanotus guambatae*** Van Zwaluwenburg, 1933

– 12,2 15,1 22,1 23,1 30,1 .. 008. ***Melanotus albernus*** Candèze, 1888

34 11,2 .. 031. ***Melanotus (TENALOMUS) fulvipennis*** Fleutiaux. 1933 (data incomplete)

– 11,1 35

35 23,3 36

– 23,1 37

36 17,1(as Figs. 33, 34, 35, 37) .... 019. ***NATOMELUS arcanus*** Dolin, 1979 (from description and figures)

– 17,2(as Fig. 32) ..... 034. ***Melanotus puberulus*** (Erichson, 1841)

37 14,1 30,1 31,2 ..... 039. ***Melanotus lewisi*** Schenkling, 1927

– 4,2 30,2 31,1 .. 016. ***Melanotus similis*** (Kirby, 1837)

38 17,1(Figs 33, 34, 35, 37) 39

– 17,2(Figs 32 ,36) 41

39 11,2 .. 031. ***Melanotus (TENALOMUS) fulvipennis*** Fleutiaux, 1933 (data incomplete)

– 11,1 40

40 23,3 ..... 019. ***NATOMELUS arcanus*** Dolin, 1979 (from description and figure)

– 23,4 ..... 035. ***Melanotus carinifer*** Champion, 1886

41 14,1 42

– 14,2 44

42 8,2 9,2 11,3 ..... 004. ***Dodecactenus guatemalensis*** Champion, 1886

– 8,1 9,3 11,1 or 11,2 43

43 11,1 ..... 036. ***Melanotus restrictus*** Candèze, 1865

– 11,2 .. 031. ***Melanotus (TENALOMUS) fulvipennis*** Fleutiaux, 1933 (data incomplete)

44 23,3 12,2 or 12,3 45

– 23,1 12,1 46

45 5,1 12,3 22,2 30,2 ..... 011. ***Melanotus depressus*** (Melsheimer, 1845)

– 5,2 12,2 22,1 30,1 ..... 009. ***Melanotus cladestinus*** (Erichson, 1841)

46 9,2 or 9,3 15,3 ..... 014. ***Melanotus hapatus*** Candèze, 1880

– 9,4 15,1 ..... 040. ***Melanotus umbilicatus*** (Gyllenhal, 1817)

KEY TO 42 TAXA USING 7 CHARACTERS

This key was made using the alternative 'Exclude characters' directive on p. 93.

The plain language version of this key appears as the 'Key to genera and one aberrant species' on p. 53.

1 7,2 (Fig. 11) 2

– 7,1(Fig. 10) 6

2 10,1(Figs 18, 18a, 19) 3

– 10,2(Figs 20, 21) 4

3 26,1(as Fig. 11a) 21,2(as Fig. 27) 29,2(Fig. 22)
... 013. ***ANCHISZOMBATYA porrectifrons*** n. sp.

– 26,2(as Fig. 10a) 21,1(Fig. 31) 29,1(as Figs 18, 18a)
..... 029. ***SZOMBATYA formosana*** (Szombathy, 1910)

4 26,2(as Fig. 10a).
.... 038. ***Neodiploconus boninensis*** van Zwaluwenburg, 1957

– 26,1(Figs 11a, 12) 5

5 19,1 ..... 005. ***NEOFLEUTIAUXIA fruhstorferi*** (Platia, 1986)

– 19,2(as Figs 38, 39)
... 020. ***NEODIPLOCONUS peregrinus*** (Candèze, 1860)
..... 021. ***Neodiploconus ciprinus*** (Candèze, 1865)
.. 022. ***Neodiploconus homostictus*** (Candèze, 1860)
... 023. ***Neodiploconus (PLOCONIDES) spiloderus*** (Candèze, 1864)
..... 024. ***PRIOPUS frontalis*** (Castelnau, 1840)
... 025. ***Neodiploconus prominens*** (Erichson, 1841)
..... 027. ***Thaumastiellus (PULCHRONOTUS) ornatus*** (Candèze, 1891)
... 030. ***THAUMASTIELLUS bioculatus*** Schwarz, 1902
.... 037. ***Neodiploconus leveri*** van Zwaluwenburg, 1940
..... 041. ***Neodiploconus (Ploconides) nigerrimus*** (Fleutiaux, 1903)

6 27,1(Fig. 19)
..... 017. ***METRIAULACUS nigrolaterus*** Schwarz, 1902
..... 018. ***Metriaulacus gobius*** (Candèze, 1860)

– 27,2(Figs 18, 18a) 7

7 19,3(Figs 40, 41) ..... 026. ***PSELLIS promiscua*** (Erichson, 1841)

– 19,2(Figs 38, 39)
..... 001. ***CRATONYCHUS obscurus*** ([sensu] Fabricius, 1775) (see p. 90)
.... 002. ***CREMNOSTETHUS nigricollis*** Schwarz, 1902
.... 003. ***DODECACTENUS staudingeri*** Candèze, 1889
..... 004. ***Dodecactenus guatemalensis*** Champion, 1896
..... 006. ***MELANOTOPSIS cete*** (Candèze, 1860)
..... 007. ***MELANOTUS fulvipes*** (Herbst, 1806)
..... 008. ***Melanotus albernus*** Candèze, 1888
..... 009. ***Melanotus cladestinus*** (Erichson, 1841)
..... 010. ***Melanotus cuneolus*** Candèze, 1860
.... 011. ***Melanotus depressus*** (Melsheimer, 1845)
.. 012. ***Melanotus guambatae*** Van Zwaluwenburg, 1933
..... 014. ***Melanotus hapatesus*** Candèze, 1880
..... 015. ***Melanotus mouldsi*** Calder, 1983
..... 016. ***Melanotus similis*** (Kirby, 1837)
.... 019. ***NATOMELUS arcanus*** Dolin, 1979 (from description & figure)
... 028. ***SPHENISCOSOMUS cuneiformis*** (Baudi, 1871)
..... 031. ***Melanotus (TENALOMUS) fulvipennis*** Fleutiaux, 1933
..... 032. ***Melanotus (KENSAKULUS) invectitus*** Candéze, 1865
..... 033. ***Melanotus annosus*** Candeze, 1865
..... 034. ***Melanotus puberulus*** (Erichson, 1841)
..... 035. ***Melanotus carinifer*** Champion, 1896
..... 036. ***Melanotus restrictus*** Candèze, 1865
..... 039. ***Melanotus lewisi*** Schenkling, 1927
.... 040. ***Melanotus umbilicatus*** (Gyllenhal, 1817)
..... 042. ***Melanotus brunnipes*** (Germar, 1824)

NOTES ON ELATERID GENERA WITH PECTINATE CLAWS

For the purposes of this discussion pectinate claws are defined as those which possess three or more 'teeth' between the base and apex of the blade of the claw. Some authors (e.g. Leseigneur, 1972) have differentiated between dentate claws (*op. cit.*: 50, fig. 8h, Adrastinae with 3 or 4 teeth) and pectinate claws (*op. cit.*: 48, fig. 8g, Melanotinae with about 8 teeth) and Stibick (1979(v): 152) distinguishes between serrate (Adrastini) and pectinate (Melanotinae) claws but many workers have not done so. Schwarz (1906: 4, 5) describes both groups as having pectinate ('gekämmt') claws and Fleutiaux (1941: 37, 38) describes the claws of the two subfamilies as 'griffes pectinées' and 'ongles pectinés'. More recently Lohse (1979: 106, figs 16, 17) used the term 'kammartigen Zähnchen' (= comb-like teeth) when referring to the two figures which are identical to those of Leseigneur.

In addition to the *Melanotus* group of genera,

pectinate claws occur in *Aptopus* Eschscholtz, *Eniconyx* Horn, *Toxognathus* Fairmaire and the 9 genera (*Adrastus* Eschscholtz, *Ctenoplus* Candèze, *Glyphonyx* Candèze (with subgenus *Microglyphonyx* Champion) *Lanecarus* Ohira, 1962(ix): 199, *Neosilesis* Ohira, 1973(v): 135, *Peripontius* Gurjeva, 1979: 314, *Silesis* Candèze, *Synaptus* Eschschholtz and *Tolphorea* Gurjeva, 1983: 81) included in the *Adrastus* group of genera (Adrastinae of Leseigneur, 1972, Lohse, 1979, Adrastini of Stibick, 1979(v)).

Apart from the pectinate claws *Aptopus* species do not differ significantly from other genera included in the *Cardiophorus* group of genera. Arnett (1962: 12 (508)) placed *Eniconyx* in synonymy with *Aptopus* without comment. As I have not been able to examine *pullatus* Horn, the type species of *Eniconyx*, the synonymy remains unconfirmed.

The affinities of *Toxognathus* are unknown. When Fairmaire erected the genus he remarked that it was 'très voisin de *Physodactylus*'. Fleutiaux (1918: 227; 1940: 104) described five new species and later (1941: 35) established the subfamily Toxognathinae to accommodate the genus, commenting that the simple tarsi and pectinate claws distinguished the group from the Physodact[yl]inae. As far as I am aware there have been no further references to the genus in the literature.

Candèze (1859: 3; 1863: 1) distinguished the *Melanotus* group (as Melanotites) from the *Adrastus* group of genera (as Adrastites) by the appearance of the anterior portion of the head ('Front muni en avant d'une carène qui form un rebord complet, bien distinct du bord qui donne insertion au labre' or 'Front dépourvu en avant, au moins sur la ligne médiane, de crête transversale, ou caréne, en deça du bord qui donne insertion au labre') and the majority of workers have followed his example, sometimes (see above) also mentioning that there is a difference in the structure of the claws. Examination of the available *Adrastus* group material has shown that in many included species the supra-antennal carinae join in the mid line to form a complete transverse carina or ridge across the front of the head which is very similar to that found in certain species belonging to the *Melanotus* group, especially those in which the frons is steeply declivous. Stibick (1979(v): 152 key couplet 10 & 173), who was evidently well aware of the very wide range of variation in the appearance of the anterior portion of the head occurring within the *Adrastus* group, used the structure of the claws, which he describes as serrate, to characterize the group, but unfortunately he did not define the terms serrate and pectinate. The fact that taxa have not been assigned to the 'wrong' group appears to be due to the fact that workers have relied more on intuition and the application of such practical methods as comparing their specimens with identified material and contenting themselves with describing how new species differ from those previously described (or their interpretation of them) without concerning themselves with the diagnostic characteristics of the family-group taxon.

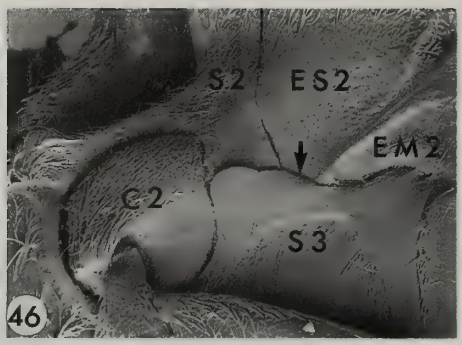
The following key to genera with pectinate claws was hand-constructed using characters drawn from the large DELTA-format data file (see p. 38). In the key a new character, the appearance of the lateral margin of the prosternum, is used to distinguish the *Melanotus* group from 7 of the 9 genera included in the *Adrastus* group. *Tolphorea* Gurjeva is unknown to me but I believe that Gurjeva's 'treble prosternal suture' [from translation] corresponds to the feature illustrated in Fig.55, x–y. Whether *Neosilesis* (Fig. 56), which lacks this feature, belongs to the *Adrastus* group is outside the scope of this work. The preliminary examination of taxa included in the *Adrastus* group has shown that they display a wide range of states of such characters as the structure of the anterior portion of the head, the structure of the margin of the mesocoxal cavity and of the claws. A critical revision of the group is highly desirable.

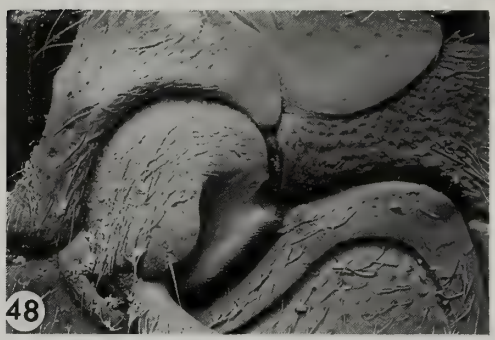
The key, which must be regarded as provisional until further investigations have been undertaken to evaluate the reliability of the characters and character states, should enable the user to assign Elateridae with 3 or more 'teeth' between the base and apex of the blade of the claw to the appropriate genus group.

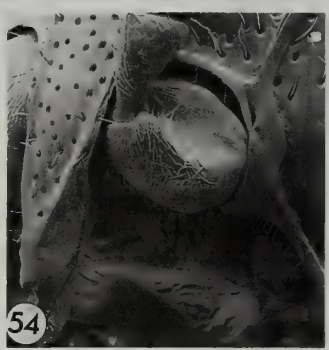
KEY TO AND NOTES ON ELATERID GENERA WITH PECTINATE CLAWS

With four exceptions, *Aptopus* and *Peripontius*, of which I have not seen the type species, *Eniconyx* which is known to me only from a specimen identified from the description, and *Tolphorea* which is entirely unknown to me, the character states have been obtained by examination of the type species. Where possible the type material has been examined. In those cases where this has not proved possible the data were obtained from specimens in the BMNH collections which are, for the purposes of this work, believed to be correctly identified. Notes and comments on the genera will be found after the key.

Character states in parentheses are not diagnostic but as my studies suggest that they probably occur in all species possessing the key characters they are included as an aid to identification.







Figs 46–54 46–52, mesocoxa and mesocoxal cavity of (46) *Aptopus priunosus*, C2–mesocoxa, EM2–mesepimeron, ES2–mesepisternum, S2, S3–meso- & metasternum, the arrow indicates the point of contact between the mesepisternum and metasternum, see p. 00, (47) *Glyphonyx bimarginatus*, the arrow indicates the suture between the mesosternum and mesepimeron, (48) *Ctenoplus nitidipennis*, (49) *Silesis musculus*, (50) *Lanecarus palustris*, (51) *Neosilesis borneoensis*, (52) *Adrastus limbatus*. 53–54, procoxa, procoxal cavity and mucro of (53) *Aptopus pruinosus*, (54) *Adrastus limbatus*.

Figs 55–56 Pronotosternal suture of (55) *Adrastus limbatus*, A–border of prosternum, B–border of hypomeron, X–Y–portion of pronotosternal suture and adjoining areas believed to correspond to Gurjeva's 'treble prosternal suture', (56) *Neosilesis borneoensis*.

1 Margin of mesocoxal cavity formed by the mesosternum and metasternum; mesepisternum in contact with metasternum, separating the mesepimeron from the mesosternum (Fig. 46, arrow); mesocoxa without emargination, trochantin not visible (Fig. 46); anterior coxal cavity narrowly open posteriorly, mucro truncate (Fig. 53); supra-antennal carinae confluent, nasale distinct ..... ***APTOPUS***

– Combination of character states not as above. (Anterior coxal cavity wide open posteriorly (Figs 13, 14, 15, 16, 17, 54); mesepisternum separated from the metasternum by the mesepimeron (Figs 23–26, 47–52)) 2

2 Blade of each mandible simple, without a tooth; anterior margin of prosternum truncate. (Pronotum wihout basal lateral incisions) ... ***TOXOGNATHUS***

– Blade of each mandible with a single tooth; anterior margin of prosternum arcuate 3

3 Lateral margins of prosternum with an impunctate or almost impunctate border arising at or near the point of divergence of prosternum and hypomeron and attaining at least the middle of the length of the pronotosternal suture (Fig. 55, A); inner margin of hypomeron with an impunctate border (Fig 55, B). (The posterior portion of the mesepisternum impunctate, or almost impunctate, and shiny, mesepimeron densely punctate and pubescent (Figs 46–52); body length 2–12 mm) 5

– Lateral margins of prosternum without an impunctate border within anterior half of their length, or if a border is present it either does not attain the middle of the length of the pronotosternal suture (Figs 18, 20, 21, 22, 56) or the pronotosternal suture lies at the base of a groove (Fig. 19) 4

4 Supra-antennal carinae not confluent in the mid line, nasale absent (Fig. 58); length 3 mm or less. (Margin of mesocoxal cavity formed by mesosternum, mesepisternum, mesepimeron and metasternum (Fig. 51); the sections of the margin of the mesocoxal cavity formed by the mesepisternum and mesepimeron are approximately equal in length)
..... ***NEOSILESIS***

– Supra-antennal carinae confluent in the mid line, nasale present (Figs 3–9); length 5–20 mm. (Structure of the margin of the mesocoxal cavity variable (Figs 23–26); if the mesepisternum forms part of the margin of the mesocoxal cavity the length of the section forming the margin is less (Fig. 26) than that of the mesepimeron; mesocoxa with anterolateral emargination, trochantin visible) ... ***MELANOTUS*** group of genera (p. 52)

5 Margin of mesocoxal cavity formed by mesosternum, mesepisternum, mesepimeron and metasternum (Fig. 52). (Tarsi simple, anterior aspect of head resembles *Synaptus* Fig. 60 & *Silesis* Fig. 61)
..... ***ADRASTUS***
[Gurjeva (1983: 82) remarks that *Tolphorea* is similar to *Adrastus* but possess a number of distinguishing features, see notes on *Tolphorea* p. 106.]

– Margin of mesocoxal cavity Fig. 50. I have been unable to establish whether the mesosternum and metasternum are in contact or whether they are separated by the mesepimeron. (Anterior aspect of head Fig. 59) ..... ***LANECARUS***

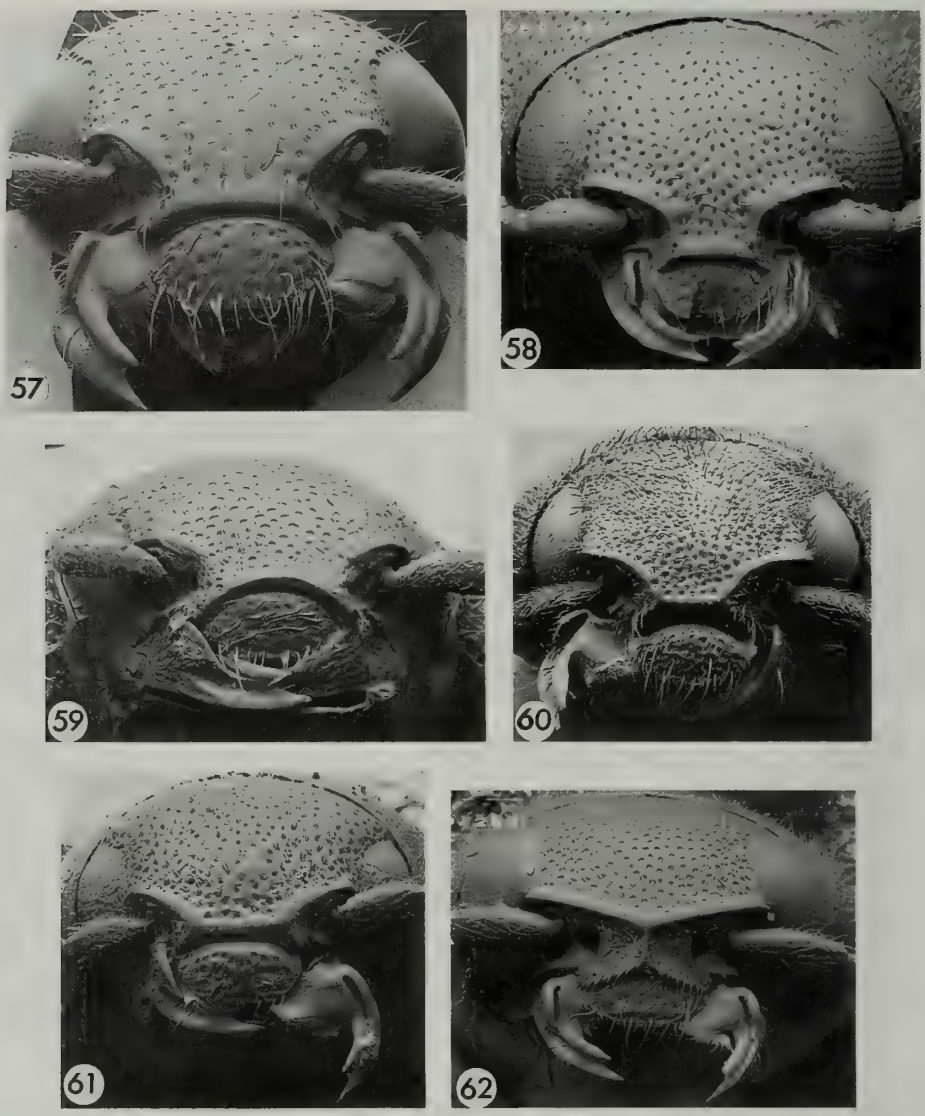
– Margin of mesocoxal cavity formed by mesosternum, mesepimeron and metasternum (Figs 47, 48, 49) 6

6 Tarsi simple. (Anterior aspect of head Fig. 57)
..... ***CTENOPLUS***

– 3rd tarsal segment with a membranous lobe extending beneath and beyond the fourth segment. (Anterior aspect of head Fig. 60) ..... ***SYNAPTUS***

– 4th tarsal segment dorsoventrally depressed 7

7 The supra-antennal carinae are directed mesad and confluent to form an angled or curved carina which may project or be depressed. The carina may be joined to the anterior margin of the head by a vertical carina 8



Figs 57–62 Anterior aspect of head of (57) *Ctenoplus nitidipennis*, (58) *Neosilesis borneoensis*, (59) *Lanecarus palustris*, (60) *Synaptus filiformis*, (61) *Silesis musculus*, (62) *Glyphonyx bimarginatus*.

– The supra-antennal carinae are directed anteriad and may attain and become confluent with the anterior margin of the head (Fig. 61) ..... ***SILESIS*, *PERIPONTIUS***

[Gurjeva (1979: 314, figs 476, 477, 483, 484 q.v.) separates these genera on the basis of the differences in shape of the mucro and the posterior coxal plate.]

8 Metasternum of normal length (approximately equal to the length of the middle femora); wings present; anterior aspect of head (Fig. 62) .... ***GLYPHONYX***

– Metasternum short (much shorter than the middle femora); wings greatly reduced in size or ?absent; frons depressed, the mid point lies close to the anterior margin of the head .. ***MICROGLYPHONYX***

ADRASTUS Eschscholtz, 1829: 35. Type species: *Elater limbatus* Fabricius, 1777: 235, by monotypy. 1 syntype, GERMANY: Chilonii [= Kiel] (ZM according to Zimsen, 1964: 160.)

Mesocoxal cavity Fig. 52; procoxal cavity and mucro Fig. 54; pronotosternal suture Fig. 55.

APTOPUS Eschscholtz, 1829: 32. Type species: *Aptopus tibialis* Eschscholtz, 1829: 32, by subsequent designation (Hyslop, 1921: 629). Type material, BRAZIL: Rio de Janeiro (?ZMUM, ?ZMUH, see Hayek, 1973: 241).

The current interpretation of the genus is that of Candèze (1860: 231) who did not know the type species, which, as far as I am aware, has not been recorded or mentioned in any publication (apart from

Hyslop, 1921) since it was described. Candèze transferred Eschscholtz' second originally included species, *ephippiger*, to *Triplonychus* and included six species originally described as *Cardiophorus* with pectinate claws by Erichson 20 years earlier.

The diagnostic characters listed in the first half of couplet 1 of the key above have been observed in 17 of the 22 species listed in the Schenkling catalogue (1925: 254–255). *A. angulicollis* Schwarz, *birmanicus* Candèze, *brevis* Candèze (also listed as (*op. cit.*: 247) as a synonym of *Cardiophorus aptopoides* Candèze), *pinchinchae* Candèze and *rugiceps* Schäffer are unknown to me.

A. pruinosus. Mesocoxa and mesocoxal cavity Fig. 46; procoxa, procoxal cavity and mucro Fig. 53.

ENICONYX Horn, 1885: 51. Type species: *Eniconyx pullatus* Horn, 1885: 52, by subsequent designation (Hyslop, 1921: 644). 2 syntypes, U.S.A.: Arizona (MCZ according to Lawrence, 1973: [152], not confirmed). [Synonymized with *Aptopus* by Arnett, 1962: 12 (508).]

Interpretation of the genus is based on a ♂ in the BMNH labeled 'Aphricus californicus, New Mexico, Dr. G. Horn' [?Horn]. The specimen agrees well with Horn's (1885: 52) description of *E. gracilis* from the same locality. I believe that Horn may have identified the specimen before he discovered (*loc. cit.*) that *Eniconyx gracilis* differed from *Aphricus*. The specimen runs down to *Aptopus* in the above key. It differs from the *Aptopus* species known to me in that the anterior margin of the prosternum is truncate and the ventral face of the mucro steeply declivous.

CTENOPLUS Candèze, 1863: 463. Type species: *Ctenoplus javanensis* Candèze, 1863: 463, by monotypy. Holotype ♀, JAVA (BMNH) [examined].

C. nitidipennis. Mesocoxa and mesocoxal cavity Fig. 48; anterior aspect of head Fig. 57.

GLYPHONYX Candèze, 1863: 451. Type species: *Glyphonyx gundlachii* Candèze, 1863, by subseqent designation (Hyslop, 1921: 647). 3 syntypes, CUBA: 1 ex. (coll. *Gundlach* acquired by Instituto de Segunda Enseñanza de la Habana, Cuba, or if retained by Candèze, ?IRSNB). 2 ex. (coll. Chevrolat, ?MNHN).

The scanning electron microscope photograph of a specimen in the BMNH collections as *Glyphonyx bimarginatus* Schaeffer shows that the mesepisternum does not form part of the margin of the mesocoxal cavity (Fig. 47, arrow) and also that the trochantin is not visible (cf. Fig. 52, *Adrastus*). In this the specimen agrees with a badly damaged specimen in the BMNH identified by Candèze as *gundlachii* Candèze . As the specimen does not bear Gundlach's name I do not think it is a syntype. Smith & Balsbaugh (1984: 13) do not describe the structure of the mesocoxal cavity of *Glyphonyx* in detail, merely remarking that the meso- and metasternum do not meet to enclose the mesocoxal cavities. Their figure (1984: 59, fig. 2) shows the mesepimeron and mesepisternum attaining the margin of the cavity but agrees with Fig. 47 in that the trochantin is not visible. A preliminary review of the available material suggests that the structure of the mesocoxal cavity of *Glyphonyx* species is that shown in Fig. 47. Smith & Balsbaugh were probably deceived by the reflections from the surface of the sternites. It was also apparent from the review that the appearance of the anterior portion of the head is variable. In some species, which lack the vertical carina, the supra antennal carinae meet to form an obtuse angle which lies in close proximity to the anterior margin of the head.

G. bimarginatus. Anterior aspect of head Fig. 62.

LANECARUS Ohira, 1962: 30. Type species: *Agriotes palustris* Lewis, 1894: 314, by original designation. 4 syntypes, JAPAN: 1 ex. Kioto, 3.vii.81; Agriotes palustris Lewis, Type [Lewis], 1 ex. Osaka [with excursion to Sakai], 7.viii.81, 1 ex. Yokohama [with excursion to Tokio], 7.iv.80, 1 ex. Ogura, 1.viii.81 (BMNH) [examined].

Lewis (1894: 26, last paragraph) stated that he recorded only a selection of localities for the species known to him. For this reason the specimen with Lewis's determination label is included in the syntype series.

Mesocoxa and mesocoxal cavity Fig. 50; anterior aspect of head Fig. 59.

MICROGLYPHONYX Champion, 1896: 549. Type species: *Microglyphonyx coarctatus* Champion, 1896: 550, by monotypy. 9 syntypes, PANAMA: V. de Chiriqui, 8000 ft (*Champion*) (BMNH) [examined].

Reduced to subgeneric status by Schwarz (1907: 293). Not included in Smith & Balsbaugh's (1984) work on *Glyphonyx*.

I believe that the rounded elytral humera and short metasternum which give the species its distinctive appearance are associated with the reduction/absence of the wings. The feature is also known to occur in other Elaterid genera, e.g. *Coptostethus*.

NEOSILESIS Ohira, 1873(v): 135. Type species: *Neosilesis borneoensis* Ohira, 1973(v): 135, by monotypy. Holotype ♂, BORNEO: Sabah (BPBM), 1 syntype (BPBM) [examined].

PERIPONTIUS Gurjeva, 1979: 314. Proposed as replacement name for *Cratonychus* Reiche & Saulcy, 1856, junior homonym of *Cratonychus* Dejean, 1833. *CRATONYCHUS* Reiche & Saulcy, 1856: 416. Type species: *Cratonychus dimidiatipennis* Reiche & Saulcy, 1856: 416, by monotypy. Type material, GREECE: Peloponnese (location unknown, ?MNHN, ?MHN).

As the type species of *Peripontius* is unknown to me the character states have been drawn from *P. terminatus* (Erichson), which was included in the genus by Gurjeva.

SILESIS Candèze, 1863: 458. Type species: *Silesis hilaris* Candèze, 1863: 461, by subsequant designation (Hyslop, 1921: 669). 1 ♂, 1 ex. syntypes, SRI LANKA: Rambodde [= Ramboda, 07° 04′ N 80° 42′ E].

Both specimens are in poor condition.

S. musculus Candèze. Mesocoxa and mesocoxal cavity Fig. 49; anterior aspect of head Fig. 61.

SYNAPTUS Eschscholtz, 1829: 32. Type species *Elater filiformis* Fabricius, 1781: 270, by subsequent designation (Hyslop, 1921: 671). Type material: ITALY (*D. Allioni*).

According to Zimsen (1964: 17) the Allioni col-

lection, which was acquired by the MIZSU, was destroyed in a fire. Zimsen (*op. cit.* : 159) also records 'Keil 3 specimens (Copenhagen 1 specimen)'.

There appears to be a general consensus of opinion concerning the identity of the type species.

Anterior aspect of head Fig. 60.

CTENONYCHUS Stephens, 1830: 272. Type species: *C. hirsutus* Stephens, 1830: 273, by monotypy. Holotype ?z, GREAT BRITAIN: Bristol (Stephens collection in BMNH) [examined]. [Synonymized with *Synaptus filiformis* by Spry & Schuckard, 1840: 40.]

TOLPHOREA Gurjeva, 1883: 81. Type species: *T. volans* Gurjeva, by monotypy. Holotype y, SW. IRAN (ZI).

The genus is unknown to me. Gurjeva remarks that it is similar to *Adrastus* but differs in the structure of the frons (Gurjeva, 1983: 81, fig. 1) which appears to resemble that of *Neosilesis* (Fig. 58) while that of *Adrastus* is not unlike *Synaptus* and *Silesis* (Figs 60 & 61). According to Gurjeva the pronotosternal sutures of *Tolphorea* are more deeply grooved than those of *Adrastus* and there are additional differences in the appearance of the mesosternal groove and posterior coxal plates (*op. cit.*, figs 2–4)

Examination of the margin of the mesocoxal cavity may shed some light on the relationship of this genus with the other members of the *Adrastus* group of genera.

TOXOGNATHUS Fairmaire, 1878: 271. Type species: *Toxognathus costulatus* Fairmaire, by monotypy. Type material, 'COCHINCHINA' [= NORTH & SOUTH VIETNAM] (*Morice*) (if retained by Fairmaire, ?IRSNB or ?MNHN).

Fleutiaux (1941: 34) erected the subfamily Toxognathinae to accommodate this genus.

Interpretation of the species is based on a specimen from Hong Kong determined by Fleutiaux in the BMNH.

INFORMATION ON LOCALITIES AND COLLECTORS

The following localities, collections and collectors are mentioned a number of times in the Elaterid literature. As I was unable to find the geographical position of some localities and had considerable difficulty in discovering that of others and also in tracing the itineraries of collectors and the present location of their collections, the available information is recorded here.

1. Localities

Kifa-juc, Enggano (? = Chifaiauc) see *Priopus enganensis* p.81.

Kosempo, Taiwan (= Kōsen) see *Szombatya formosana* p. 81.

Liangagas, ?Sumatra geographical position unknown, see *Melanotus altercuneolus* p. 81.

Man-son
Montes Mauson
Monts Mauson
Mau-son
} Tonkin (= Vietnam) see *Priopus mirabilis* p. 82.

Soekaranda, ?Sumatra (? = Soekarandja) see *Melanotus altercuneolus* p. 61.

Teikorai, Java
Teykorai, "
} ? = Mt. Chikorai see *Melanotus dispunctatus* p. 64 and

Tsikorai, "
} see *M. pulvereus* p. 70

Tonglo, Sikkim (? = Tonglu) see *Melanotus nigricollis* p. 68.

2. Collectors and collections

Fruhstorfer, travels. Fruhstorfer, 1905.

Knull collection. Bequeathed to the Field Museum, Chicago (C. Triplehorn, pers. comm. ix.1988).

Lewis, travels in Japan. Bates, 1883.

Melsheimer family and collections. Hagen, 1884.

Miwa collection. The type material of some, and possibly all, the species described from Formosa (Taiwan) is in the Agricultural Research Institute, Taipei (H. Ohira, pers. comm. 1974). See *Metriaulacus formosanus* p. 76.

Lorquin, travels. Boisduval, 1873 and Gimmel, 1904 and see also *Neofleutiauxia* specimens in BMNH p. 84.

Modigliani, Enggano localities. Modigliani, 1894.

Sauter, Formosan localities. Esaki, 1941.

Acknowledgements. I am much indebted to Mr R. Pankhurst (Botany Department, BMNH), who made available his key, description-writing and interactive identification programs and was unstinting with help, advice and encouragement during the course of the work.

My grateful thanks are due to the following for the loan of type and other material and for valuable information in reply to my inquiries: Dr L. Baert (IRSNB), Dr C. Girard (MNHN), Dr F. Hieke (MNHU), the late Dr Z. Kaszab and Dr O. Merkl (TM), Dr A. Neboiss (NMV), Dr G. A. Samuelson, (BPBM), Professor C. A. Triplehorn (Department of Entomology, Ohio State University), Dr C. Verstraeten (IRSNB). I am grateful to my colleagues at the British Museum (Natural History): Mr D. Claugher and Ms S. H. Barnes of the Electron Microscope Unit for help with the preparation of the scanning electron micrographs, and members of the Photographic Unit for the other illustrations. My especial thanks are due to Mr R. T. Thompson and Mr P. M. Hammond for reading the manuscript and making many helpful comments.

REFERENCES

Roman numerals in parentheses after the year of publication indicate the month of publication.

Arnett, R. H. 1955. Supplement and corrections to J. A. Hyslop's Genotypes of the Elaterid beetles of the world. *Bulletin of the United States National Museum* **103:** 599–619.

—— 1962. *The Beetles of the United States* (A manual for identification). Fascicle **46**: 16 pp. Washington, D. C.

[The pages are also numbered (497)–(412). The work was fist issued as a series of fascicles with separate pagination and later (1968) reprinted with the above pagination. A new edition apeared in 1973.]

Bates, H. W. 1866(ix). On a collection of Coleoptera sent home by R.Swinhoe, Esq., H.B.M. Consul, Formosa. *Proceedings of the Zoological Society of London* **1866:** 339–355.

[For the date of publication see Duncan, 1937.]

—— 1883. Supplement to the Geodephagus Coleoptera of Japan, chiefly from the collection of Mr. George Lewis, made during his second visit from February, 1880 to September, 1881. *Transactions of the Entomological Society of London* **16:** 205–290, 1 map, 1 pl.

[An account of Lewis' itinerary appears on pp. 210–213.]

Becker, E. C. 1956. Revision of the Nearctic species of *Agriotes* (Coleoptera: Elateridae). *The Canadian Entomologist* **88** supplement 1: 101 pp., 74 figs.

—— 1958. The phyletic significance of the female internal organs of reproduction in the Elateridae. *Proceedings of the 10th International Congress of Entomology, Montreal, 1956* **1:** 201–205, 17 figs.

—— 1971. Five new species of *Megapenthes* from the southwestern United States, with a key to the Nearctic species (Coleoptera: Elateridae). *The Canadian Entomologist* **103:** 145–167.

—— 1974. Revision of the Nearctic species of *Athous* (Coleoptera, Elateridae) east of the Rocky Mountains. *The Canadian Entomologist* **106:** 711–758.

Binaghi, G. 1939(vii). I Melanotini della fauna Italiana. *Memorie della Società Entomologica Italiana* **17**(1938): 205–239.

—— 1939(xii). I Melanotini dell'Africa del Nord. *Bollettino della Società Entomologica Italiana* **71:** 174–180.

Blackwelder, R. E. 1974. *North American Beetle Fauna Project; Family no. 46, complete (Red version). Checklist of the Elateridae of Canada, United States, Mexico, Central America and the West Indies*. 55 pp. Latham, N.Y.

[As far as I am aware no further versions have appeared to date.]

Blanchard, E. 1845. *In* D'Orbigny, *Voyage dans l'Amérique méridionale.* **6(2).** *Insects d'Amérique méridionale recueillis par A. D'Orbigny*. 222 pp. [1836–47], 32 pls [1835–45].

[The dates of publication of the separate parts were obtained from Sherborn & Griffin, 1934.]

Blatchley, W. S. 1927. Some new species of Coleoptera from Indiana and Florida. *Entomological News* **38:** 139–144.

Blunk, H. & Muhlmann, H. 1954. *In* Blunk, H., *Handbuch der Pflanzenkrankheiten*. edn 5, **5**(2), Coleoptera, Elateridae: 25–61. Berlin & Hamburg.

Boisduval, [J. B. A. D.] de 1873. Note nécrologique sur Lorquin, Naturaliste-Voyageur. *Annales de la Société Entomologique de France* **6:** [5]–10.

Boisduval, J. B. A. D. de & Lacordaire, T. 1835. *Faune Entomologique des Environs de Paris* **1:** 696 pp., 3 pls. Paris.

Britton, E. B. 1986. A revision of the Australian Chafers (Coleoptera; Scarabaeidae: Melolonthinae) Vol. 4. Tribe Liparetrini: Genus *Colpochila*. *Australian Journal of Zoology* Supplementary Series No. 118: 135 pp., 374 figs.

Brullé, A. 1832. *Expédition Scientifique de Morée*. Section des Sciences Physiques. **3**(1), Zoologie, Deuxième section. Des animaux articulés. 400+[2] pp. Paris.

Buysson, H. du 1894. *Faune Gallo-Rhénane*, E'latérides. *Melanotus*: 128–136.

[This work was published in parts, with consecutively numbered pages, as supplements to the *Revue d'Entomologie*. The first part appeared with volume 11 part 11, the issue for October 1892, which probably did not appear until early the following year (see date 'décembre 1892 on p. [2]). The last part appeared with the issue for March 1906.]

—— 1918. Contributions à la faune du Maroc: Elatérides (Col.). *Bulletin de la Societé d'Histoire Naturelle d'Afrique Nord* **9:** 109–112.

—— 1924. Indications relatives à la faune du Maroc. *Bulletin de la Société des Sciences Naturelles du Maroc* **4:** 204–210.

Calder, A. A. 1983. *Melanotus* Eschscholtz, a genus new to Australia (Coleoptera: Elateridae). *Journal of Australian Entomology* **22:** 257–260.

—— 1986. Classification, relationships and distribution of the Crepidomeninae (Coleoptera: Elateridae). *Australian Journal of Zoology*, Supplementary Series No. 122: 220 pp., 276 figs.

Candèze, E. 1857. Monographie des Elatérides **1**: vii + 400 pp., 7 pls. *Mémoires de la Société royale des Sciences de Liège* **12.**

—— 1860. Monographie des Elatérides **3:** vii + 512 pp., 5 pls. *Mémoires de la Société royale des Sciences de Liège* **15.**

—— 1865. Elatérides nouveaux [1]. *Mémoires Couronnés et autres Mémoires publiés par L'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belge*. Collection in 8°. **17**(1): 63 pp.

—— 1873. Insectes recueillis au Japon par M. G. Lewis pendant les années 1869–1871. Elatérides. *Mémoires de la Société royale des Sciences de Liège* (2) **5:** [i]–ii + 32 pp.

—— 1882. Elatérides nouveaux. Troisième Fascicule. *Mémoires de la Société royale des Sciences de Liège* (2) **9:** ii + 117 pp.

[The date of publication of this work is often cited as 1881, possibly because this date appears at the end of the *Avant-Propos*.]

—— 1888. Viaggio di Leonardo Fea in Birmania e regioni vicine. XIV. Elatérides recueillis en Birmanie par M. L. Fea pendant les années 1885–1887. *Annali del Museo Civico di Storia Naturale Giacomo Doria, Genova* (2) **6:** 771–793.

—— 1889. Elatérides nouveaux, Quatrième fasicule. *Annales de la Société Entomologique de Belgique* **33:** [67]–123.

[The page numbers given in the Schenkling (1927) catalogue suggest that this paper was also issued with separate pagination. The separate is unknown to me. The page numbers given by Schenkling will be found, in parentheses, after the main reference.]

—— 1890. Note sur les Elatérides du Chota-Nagpore. *Annales de la Société Entomologique de Belgique* **34:** cxlvi–clvii.

—— 1891(v, possibly earlier). *Catalogue Mèthodique des Elatérides connus en 1890*. [v]–xii + [1]–246 pp. Liège.

[The Société Entomologique de Belgique received a copy of this paper at the meeting on 2nd May, 1891 (*Bulletin de la Société Entomologique de Belgique* **35:** ccxxvi).]

—— 1891(vi). Viaggio di Leonardo Fea in Birmania e regioni vicine XXXVI. Elatérides recueillis en Birmanie par M. L. Fea. *Annali del Museo Civico di Storia Naturale Giacomo Doria, Genova* (2) **10:** 771–793.

—— 1892. Deuxiéme note sur les Elatérides du Chota-Nagpore. *Annales de la Société Entomologique de Belgique* **36:** 480–495.

—— 1897. Elatérides nouveaux. Sixième fascicule. *Mémoires de la Société Royale des Sciences de Liége* (2) **19**(2): 88 pp.

[The date of publication of this work is often recorded as 1896; Candèze may have had copies of the paper available for distribution at the end of 1886, but the cover of the volume in which it appears is dated Janvier 1897.]

—— 1900. Elatérides nouveaux, Septième fasicule. *Annales de la Société Entomologique de Belgique* **44:** 77–101.

[The page numbers given in the Schenkling (1927) catalogue suggest that this paper was also issued with separate pagination. The separate is unknown to me. The page numbers given by Schenkling will be found, in parentheses, after the main reference.]

Castelnau, F. L. de Laporte, Comte de 1838. Etudes entomologiques. *Revue Entomologique (Silbermann)* **4:** 6–60.

[For the date of publication of this work see Hayek, 1983. The table accompanying the paper is by Eschscholtz, q.v.]

—— 1840. *Histoire naturelle des insectes,* Coléoptères. **1:** cxxv + 324 pp., 19 pls. Paris.

Champion, G. C. 1894–1896. *In*: *Biologia Centrali-Americana*, Insecta, Coleoptera. **3**(1): 258–556, Serricornia, Elateridae , 12 pls (nos 12–23). London. [pp. 258–296, 1894; pp. 297–440, 1895; pp. 441–556, 1896.]

Chujo, M. & Ohira, H. 1965. Elaterid- and Dichronychid-Beetles from the Aomori Pref., Japan, collected by Mr. Kensaku Shimoyama. *Memoirs of the Faculty of Liberal Arts and Education Kagawa University*, Part 2, No. 132: 30 pp.

Cobos, A. 1958. Primera contribución al estudio de los Elateridae (Coleoptera) del norte de Africa. Descriptiones diversas. *Bulletin de la Société des Sciences Naturelles et Physiques du Maroc* **38: 51–57.**

Curtis, J. 1854. Critical remarks upon the British Elateridae, with descriptions of some of the species. *Transactions of the Entomological Society of London* (N. S.) **3:** 10–17, 1 pl.

Dallwitz, M. J. & Paine, T. A. 1986. User's guide to the DELTA system. A general system for processing taxonomic descriptions. *Report No.13*, edn 3: 106 pp. *CSIRO Division of Entomology. Canberra.*

Dejean, P. F. M. A. 1831. *Species général des Coléoptères*. **5:** 883 pp. Paris.

—— 1833 [–36]. *Catalogue des Coléoptères de la collection de M. le Comte Dejean* [edn 2]. 443 pp. Paris.

[For dates of publication of the parts see Madge, 1989.]

—— 1836–[37]. *Catalogue des Coléoptères de la collection de M. le Comte Dejean.* Troisième E'dition. xiv + 508 pp. Paris.

[For dates of publication of the parts see Madge, 1989.]

Dillwyn, L. W. 1829. *Memoranda relating to coleopterous insects found in the neighbourhood of Swansea.* Title page, [i–ii] & 75 pp. Privately printed by Murray & Rees, Swansea.

[Green paper covers without printing are bound in with the British Museum (Natural History) library copy. Dillwyn's introduction on p. [i] is dated November 1829.]

—— 1848. *Materials for a Fauna and Flora of Swansea and the neighbourhood*. Title page, [i–ii] & 44 pp. Privately printed by David Rees, Swansea. The title page bears the legend 'Not Published'. See p. 57.

Dolin, V. G. 1960. The larvae of Elaterid-Beetles belonging to the genus *Melanotus* Esch. (Coleoptera, Elateridae) in the European part of the USSR. *Zoologicheskii Zhurnal* **39:** 1032–1038. [In Russian with an English summary.]

—— 1971. New species of click beetles (Coleoptera, Elateridae) from the Soviet Union. *Entomological Review, Washington* **50:** 362–374, 16 figs. Translation of paper in *Entomologicheskoye Obozrenie* **50:** 641–654.

—— 1975. Wing venation in Click-Beetles (Coleoptera, Elateridae) and its significance in the taxonomy of the family. *Zoologicheskii Zhurnal* **54:** 1618–1633. [In Russian with an English summary.]

[An English translation has been prepared by the Translation Bureau, Department of Agriculture, Research Branch, Ottawa, Canada. 36 pp. The original pagination is given in the margin of the translation.]

—— 1978. *Opredelitel' lichinok zhukov-shchelkunov fauny SSSR*. Urozhai, Kiev.

[Translated into English for the U.S. Department of Agriculture and the National Science Foundation, Washington D.C. by the Al-Ahram Centre for Scientific Translations, 1981 with the title: *Table for the Identification of Click Beetles Larvae of the USSR Fauna*. 245 + [2] pp., 262 figs.]

—— 1979. New genus and species of click-beetles of the tribe Melanotini. *Trudy Vsesoyuznogo Entomologicheskogo Obshchestva* **61:** 71–72. [In Russian with an English summary.]

Dolin, V. G. & Kurcheva, G. F. 1975. New larval forms of Elateridae (Coleoptera) from the Far East. *Trudy Biologo-Pochvennogo Instituta ANSSSR* **28:** 113–118, 3 figs. [In Russian.]

du Buysson, H. see **Buysson, H. du.**

Duncan, F. Martin 1937. Dates of publication of the Society's Proceedings 1859–1926. *Proceedings of the Zoological Society of London* (A)**107**: 71–77.

Erichson, W. F. 1841. Ueber die Elateriden mit kammfömig gezähnten Krallen. *Zeitschrift für die Entomologie (Germar)* **3:** [87]–129.

[American cataloguers (e.g. Leng, 1920; Blackwelder, 1974) and other workers (e.g. Quate & Thompson, 1967) cite this work with the date 1842. However, as Erichson (1842) mentions other papers included in the same volume of the journal in his review of entomological works published in 1841, I see no reason to reject the date on the title page. The error may have its origin in a misprint in the Leng catalogue. On p.174 the author of *Melanotus decumanus* is recorded as '(Er.) 42–104' but there is no corresponding reference in the bibliography. The reference, with the date 1842, is listed in the corrections to p. 354 of the bibliography in Leng & Mutchler's Supplement (1927: [72]) to the catalogue.]

—— 1842. Bericht úber die Leistungen in der Naturgeschichte der Insecten, Arachniden, Crustaceen und Entomostraceen wáhrend des Jahres 1841. *Archiv für Naturgeschichte* **8** (2): 189–330.

Esaki, T. 1941. Hans Sauter. *Arbeiten úber morphologische und taxonomische Entomologie* **8:** [81]–86.

[The paper includes a list of Sauter's Formosan localities with their present-day names.]

Escalera, M. M. de la 1914. Los Coleópteros de Marruecos. *Trabajos del Museo Nacional de Ciencias Naturales*, Serie Zoológica, Núm. 11: 553 pp.

Eschholtz see **Eschscholtz**

Eschscholtz [as Eschholtz], **J. F.** 1829. Elaterites, Eintheilung derselben in Gattungen. *In* **Thon,** *Entomologisches Archiv* **2(1):** 31–35. Jena. [A note by Thon on the reverse of the title page is dated January 1829.]

—— 1838. Table entitled 'Classification des E'latérides de M. Eschscholtz'. *In* Castelnau, F. L. de Laporte, Comte de. 1838. E'tudes entomologiques. *Revue Entomologique (Silbermann)* **4:** 6–60.

Fabricius, J. F. C. 1775. *Systemae entomologiae*. xxxii + 832 pp. Flensburgi & Lipsiae.

—— 1781. *Species insectorum*. **1:** viii + 552 pp. Hamburgii & Kilonii.

—— 1792. *Entomologia systematica*. **1** (2): xx + 538 pp. Copenhagen.

—— 1798. *Supplementum entomologiae systematicae*. 572 pp. Hafniae.

—— 1801. *Systema eleuthatorium*. **1:** xxiv + 506 pp.; 2: 687 pp. Kiliae.

Fall, H. C. 1934. On certain North American Elateridae, new and old. *Journal of the New York Entomological Society* **42:** 7–36.

Fleutiaux, E. 1895. Contributions à la faune Indo-chinoise, 15^{e} Mémoire. Première addition aux Cicindelidae et Elateridae. *Annales de la Société Entomologique de France* **63** (1894): 682–690.

[The date of publication of this work is usually recorded as 1894, but the fourth part of the *Annales* in which it appears was not not published until 30 May, 1895. See *Bulletin de la Sociéte Entomologique de France* (1894) 1895: [cccxxxv] and the date on the cover.]

—— 1903. Contributions à la faune Indo-chinoise (Indo-chine Francaise), 18^{e} Memoire. *Annales de la Société Entomologique de France* **7** (1902): 569–580.

[The date of publication of this work is usually recorded as 1902, but the third part of the *Annales* in which it appears was not published until 14 January, 1903. See *Bulletin de la*

Société Entomologique de France **1903:** 6 and the date on the cover.]

—— 1914. Elateridae des Iles Philippines. *Philippine Journal of Science* **9**, No. 5, Sec. D: 441–449.

—— 1918(vi). Coléoptères Elatèrides Indochinois de la collection du Muséum d'Histoire Naturelle de Paris. Catalogue et description des espèces nouvelles. *Bulletin du Muséum d'Histoire Naturelle. Paris* **1918:** 205–236.

[This is one of the two works included in Fleutiaux, 1924 (see below).]

—— 1918((xii). Nouvelles contributions à la faune de l'Indochine Francaise. *Annales de la Société Entomologique de France* **87:** 175–278.

[This is one of the two works included in Fleutiaux, 1924 (see below).]

—— 1923. Descriptions de deux espéces nouvelles d'Elateridae du genre *Diploconus*. *Bulletin de la Société Entomologique de France* **1923:** 12–14.

—— 1924. Faune Entomologique de l'Indochine Francaise, Fascicule no. 7, Melasidae et Elateridae. *Opuscules de L'Institut Scientifique de L'Indochine* No. 2: 184 pp.

[The Elateridae occupy pp. 31–184. There are references to this work in the Schenkling catalogue and in other publications. A note by Vitalis de Salvaza on an unnumbered leaf between pages 30 and 31 states that it is made up of two of Fleutiaux' 'études splendides . . . '. The works are Fleutiaux, 1918(vi) and 1918(xii) recorded above. All the 'n. sp' appearing in this work were published in 1918.]

—— 1926. Remarques et observations sur le Catalogue des Elateridae, 1re partie, de M. S. Schenkling. *Annales de la Société Entomologique de France* **95:** 91–112.

—— 1932. Coléoptéres des Iles Mascareignes, Mission Scientifique de P. Carie (1910–1913); Melasidae et Elateridae. *Annales de la Société Entomologique de France* **101:** 25–39.

—— 1933. Les Elaterides de l'Indo-Chine Francaise (5^{e} partie). *Annales de la Société Entomologique de France* **101:** 205–235.

—— 1940. Elatérides nouveaux. *Bulletin et Annales de la Société Royale Entomologique de Belgique* **80:** 89–104.

—— 1941. Les Elatérides de L'Indochine Francaise (Huitième et dernière partie). *Annales de la Société Entomologique de France* **109** (1940): 19–40.

—— 1942. Entomological results from the Swedish expedition to Burma and British India. Coleoptera: Elateridae, recueillis par René Malaise. *Arkiv för Zoologi* **33a** (18): 24 pp.

—— 1945. Historique de la collection d'Elatérides de Candèze actuellement au Musée d'Histore naturelle de Bruxelles. *Revue Francaise d'Entomologie* **12:** 79–81.

Fruhstorfer, H. 1905. *Tagebuchblätter*. 721 pp. Leipzig.

Gaedike H. 1985. Katalog in der Sammlung der Abteilung Taxonomie der Insecten des Institutes für Pflanzenschutzforschung, Bereich Eberswalde (ehemals Deutsches Entomologisches Institut) aufbewahrten typen – XXIII. *Beiträge zur Entomologie* **35:** 13–96.

Gaedike, R. 1969. Bibliographie der Elateridenlarven-Literatur der Welt [to 1967]. *Beiträge zur Entomologie* **19:** [159]–266.

—— 1975. Bibliographie der Elateridenlarven-Literatur der Welt (1968–1972). *Beiträge zur Entomologie* **25:** [85]–98.

—— 1979. Bibliographie der Elateridenlarven-Literatur der Welt (1973–1977). *Beiträge zur Entomologie* **29:** [307]–317.

Gemminger, [M.] & Harold, E. von 1869. *Catalogus Coleopterorum* **5:** 1347–1608 [+ 6]. Monachii.

Gimmel, F. 1904. An early collector in California. [Lorquin.] *Entomological News* **15:** 202–204.

Griffin, F. J. 1932(iii). On the dates of publication and contents of the parts of Westwood, J. O. Introduction to the modern classification of insects, 1838–1840. *Proceedings of the Royal Entomological Society of London* **6:** 83–84.

—— 1932(v). A note on an almost unknown work on Coleoptera. [Yakobson, 1913.] *The Entomologist's Monthly Magazine* **68:** 65–66.

Guimarães, J. S. 1933. Larva procedente de Entre-Rios, Estado da Bahia, e inseto adulto creados no laboratioio de patologia vegetel, em ondina. *Boletim da Agricultura Comercio e Industria Bahia* Numeros **11 & 12:** 16–20.

Gullan, P. J. 1977. A revision of the genus *Anilicus* Candèze, with notes on related genera (Coleoptera: Elateridae). *Memoirs of the National Museum of Victoria* No. 38: 209–130, 3 pls (nos 4, 5 & 6).

Gurjeva, E. L. 1973. A new tribe, Megapenthini Tribus N. (Coleoptera, Elateridae). *Zoologischiskii Zhurnal* **53:** 448–451. [In Russian with an English summary.]

—— 1974. Thoracic structure of Click–Beetles (Coleoptera, Elateridae) and the significance of the structural characters for the system of the family. *Entomological Review* **53:** 67–79.

[The work originally appeared, in Russian, in *Entomologicheskoe Obrozrenie* **53:** 96–113.]

—— 1979. *Fauna SSSR*, N. S.; no. 118. **12** no. 4. Coleoptera: Click Beetles (Elateridae), subfamily Elaterinae, tribes Megapenthini, Physorhinini, Ampedini, Elaterini, Pomachilini. 451 + [5] pp, 787 figs. Leningrad.

—— 1983. New species and genus of the click-beetles (Coleoptera, Elateridae) from Iran. *Vestnik Zoologhii* **3**(5): 81–82. [In Russian with an English summary.]

Gur'yeva, Ye. L. see **Gurjeva, E. L.**

Haekel, E. [H. P. A.] 1861. Neue lebende Radiolarien des Mittelmeeres. *Monatsberichte der Königlichen Preussichen Akademie der Wissenchaften zu Berlin* **1860:** 794–817.

[The paper was read at the meeting held on 13th December, 1860.]

—— 1862. *Die Radiolarien (Rhizopoda Radiata)*. Eine Monographie. xiv + 572 pp. Berlin.

Hagen, H. A. 1884. The Melsheimer family and the Melsheimer collection. *The Canadian Entomologist* **16:** 191–197.

Hampson, G. 1906. *In* [Lankester, E. R., director and author of preface to volume **1**], *The history of the collections contained in the Natural History Departments of the British Museum* **2:** 604–653. *Tabulation of orders and families of Insecta with date of arrangement of the British Museum collection*. London.

Harold, E. von 1869(a). *In* Gemminger & Harold, *Catalogus Coleopterorum* **5:** 1487–1604, Elateridae. The section on the Elateridae was prepared by Harold (*op. cit.* 1868 **1:** xxxiv).

—— 1869(b) Bemerkungen zu den Elateridae im Stein'schen Catalogue. *Coleopterologische Hefte* (ed. Harold) **5:**88–94. This work also contains corrections to Harold, 1869(a).

Hayek, C. M. F. von 1973. A reclassification of the subfamily Agrypninae (Coleoptera, Elateridae). *Bulletin of the British Museum (Natural History)* (Entomology) Supplement 20: 309 pp.

—— 1979. Additions to 'A reclassification of the subfamily Agrypninae (Coleoptera, Elateridae)'. *Bulletin of the British Museum (Natural History)* (Entomology) **38**: 183–261.

—— 1983. The date of publication of the fourth volume of Silbermann's *Revue Entomologique*. *Archives of Natural History* **11:** 207–208.

Henshaw, S. 1895. *Third supplement to the List of Coleoptera of America North of Mexico*. 62 pp. Philadelphia.

Hope, F. W. 1831. Synopsis of the new species of Nepaul insects in the collection of Major General Hardwicke. *In* J. E. Grey, *The Zoological Miscellany of London* **1** (1): 21–32.

—— 1840. *The Coleopterist's Manual*, part 3. 191 pp., illustrated. London

—— 1843. Descriptions of coleopterous insects sent to England by Dr. Cantor from Chusan and Canton with observations on the entomology of China. *Annals and Magazine of Natural History* (1) **11:** 62–66.

[This is a short version of a paper with the same title published in 1845, in the *Transactions of the Entomological Society of London* **4:** 4–17.]

Horion, A. 1953. *Faunistic der Mitteleuropäischen Käfer*. **3:**

Malacodermata, Sternoxia (Elateridae bis Throscidae). 340 pp. München.

Horn, G. H. 1879. Communication on the Elateridae. *Proceedings of the Entomological Section of the Academy of Natural Sciences* in *Transactions of the American Entomological Society* **7:** xiv–xvi.

—— 1885. A study of some genera of Elateridae. *Transactions of the American Entomological Society* **12:** 50–52.

[The first part of this paper (pp. 33–49) appeared in 1884.]

Horn, W. & Kahle, I. 1935–1937. Über entomologische Sammlungen, Entomologen & Entomo–Museologie. *Entomologische Beihefte* **2–4.** vi + 536 pp., 38 pls, 3 text figs.

Hyslop, J. A. 1915. Wireworms attacking cereal and forage crops. *Bulletin of the United States Department of Agriculture* **156:** 34 pp.

—— 1917. The phylogeny of the Elateridae based on larval characters. *Annals of the Entomological Society of America* **10:** 241–263.

—— 1921. Genotypes of the Elaterid beetles of the world. *Proceedings of the United States National Museum* **58:** 621–680.

Jacquelin du Val, C. 1859. *Genera des Coléoptères d'Europe*. **3:** 1–236. Paris.

[The remainder of the volume (pp. 237–463) appeared in three parts between 1860 and 1863.]

Janson, E. W. 1855. Observations on the species of Elateridae described by Mr. Curtis in the first part of the third volume of the new series of the *Transactions of the Entomological Society of London*. *Transactions of the Entomological Society of London* (N. S.) **3:** 222–224.

Jeuniaux, C. 1955. Sur les Elatéroïdes paléarctiques. *Bulletin & Annales de la Société Royale Entomologique de Belgique* **91:** 230–237.

Junk Catalogue see **Schenkling, S.** 1925 & 1927.

Kiesenwetter, H. von 1858. *Naturgeschichte der Insecten Deutschlands*. Erste Abtheilung. Coleoptera **5**(2) (signatures 12–24, pp. 179–384). Berlin.

[The complete work was published in four parts between 1857 and 1863 (Kiesenwetter, *op.cit.*: vi).]

—— 1870. Bemerkungen zur Nomenclatur der Elateriden. *Coleopterologische Hefte* (ed. Harold) **6:**34–36.

Kishii T. 1961. Elateridae of Is. Tsushima. *Bulletin of the Heian High School, Kioto* no. 5: 1–56, 11 pls.

—— 1964. Elateridae of Islands Awa-shima, Hegura-shima and Nanatsu-jima 'The Snappers of Islands (IV)'. *Bulletin of the Heian High School, Kioto* no. 8: 1–37, 3 pls.

—— 1977. Elaterid beetles from Europe collected by Mr. A. Shinohara with descriptions of some new forms and notes. *Bulletin of the Heian High School, Kyoto* no. 21: 19–34, 5 pls.

Kishii, T. & Ohira, H. 1956. Snappers of the Niigata-Prefecture, especially on the collection by Dr Kintaro Baba, with descriptions of some new forms. *Akitu* **5:** 71–84.

Knull, J. N. 1959. Two new species of *Melanotus* (Coleoptera: Elateridae). *The Ohio Journal of Science* **59:** 280–281, 2 figs.

—— 1962. A new *Melanotus* from the Chiricahua Mountains of Arizona. *The Ohio Journal of Science* **62:** 34–35.

Königsmann, E. 1970. Die Entomologischen Sammlungen des Zoologischen Museum. *Wissenschaftlichen Zeitschrift der Humboldt Universität zu Berlin* **19:** 168–170.

Laboissière, V. 1933. Observations sur les Galerucini asiatiques principalment du Tonkin et du Yunnan et descriptions de nouveaux genres et espèces (4e partie). *Annales de la Société Entomologique de France* **101:** [51]–72.

Lacordaire, T. 1857. *Histoire naturelle des insectes. Genera des Coléoptères*. **4:** 579 pp. Paris.

Laporte, F. L. de see **Castelnau**.

Latreille, P. A. 1834. Distribution méthodique et naturelle des genres des diverses tribus d'insectes Coléoptéres de la famille des Serricornes. *Annales de la Société Entomologique de France* **3:** 113–170.

Lawrence, J. F. 1973. Horn and Dietz Collections move to Harvard. *The Coleopterist's Newsletter* **27:** [151].

LeConte, J. L. 1853. Revision of the Elateridae of the United States. *Transactions of the American Philosophical Society* **10:** 405–508.

Leng, C. W. 1920. *Catalogue of the Coleoptera of North America, North of Mexico*. x + 470 pp. Mount Vernon, N. Y.

Leng, C. W. & Mutchler, A. J. 1927. *Supplement 1919 to 1924 (inclusive) to Catalogue of the Coleoptera of America, North of Mexico*. 78 pp. Mount Vernon, New York.

—— 1933. *Second and third supplements 1925 to 1932 (inclusive) to the Catalogue of the Coleoptera of America, North of Mexico*. 122 pp. Mount Vernon, N. Y.

Leraut, P. de 1981. Les Elaterides décrits par E. L. Geoffroy. *L'Entomologiste* **37:** 95–98.

Leseigneur, L. 1972. Coléoptères Elateridae de la Faune de France Continentale et de Corse. *Bulletin Mensuel de la Société Linnénne de Lyon*, **41**, Supplément au numéro de Février 1972: 279 + [2] pp. Illustrated.

Lewis, G. 1894. On the Elateridae of Japan. *Annals and Magazine of Natural History* (6) **13:** 182–201.

—— 1896. On new species of Coleoptera from Japan, and notices of others. *Annals and Magazine of Natural History* (6) **17:** [313]–343.

Linnaeus, C. von 1758. *Systema naturae*. 10th edn **1:** [ii + 5] + 833+ [1] pp. Holmiae.

—— 1761. *Fauna suecica, sistens animalia* . . . etc. Edn alt., [xlvi] + 578 pp, 2 pls. Stockholmiae.

—— 1766. *Systema naturae*. 12th edn **1:** 532 pp. Holmiae.

Lohse, G. A. 1979. *In* Freude, Harde & Lohse, *Die Käfer Mitteleuropas; Elateridae*, **6:** 103–186. Krefeld.

Madge, R. B. 1989. The publication dates of Dejean's catalogues. *Archives of Natural History* **15:** 317–321.

Megerle von Mühlfeld, J. K. 1801. *Catalogus Insectorum quae Viennae Austriae die 14 et seq. Decembris 1801 auctionis lege distribuuntur*. [Not seen.]

Melsheimer, F. E. 1845. Descriptions of new species of Coleoptera of the United States. *Proceedings of the Academy of Natural Sciences of Philadelphia* **2** (6): 134–160.

[The date of this work is usually cited as 1846, the date on the title page of volume 2 which covers the years 1844 and 1845. This work appeared in 12 parts each containing the proceedings of the meetings of two consecutive months. No. 6 (pp. [127]–188 + [2]) is a record of the meetings held in November and December 1844. Nolan (1913: x) records that the part had been received by the American Philosophical Society by February 7th, 1845.]

Miwa, Y. 1927. New and some rare species of Elateridae from the Japanese Empire. *Insecta Matsumurana* **2:** 105–113.

—— 1929. The Elaterid-fauna of Loo-Choo. *Transactions of the Natural History Society of Formosa* **19:** 339–357.

—— 1930. Elateridae of Formosa (IV). *Transactions of the Natural History Society of Formosa* **20:** 57–68.

—— 1934. The fauna of Elateridae in the Japanese Empire. *Department of Agriculture Government Research Institute Formosa, Japan*. Report no. 65: 289 pp., 9 pls.

Miwa, Y. & Yanagihara, M. 1929. The effect of Elaterid-beetles upon sugar-cane planting in Formosa. *Journal of the Society of Tropical Agriculture* **1:** 275–289. [In Japanese with an English summary.]

Modigliani, E. 1894. *L'Isola delle Donne. Viaggio ad Engano*. 35 pp., 25 pls, 50 figs & 1 map. Milan.

Moffat, H. R. 1976. M. C. Lane, 1893–1975. Obituary. *Journal of Economic Entomology* **69:** 702.

Murray, J. 1920. *A handbook for travellers in India, Burma & Ceylon*. edn 10 (reprint). 726 pp., maps. London.

Nakane, T. 1956. *Coloured illustrations of the insects of Japan: Coleoptera*, Supplement. 51 pp., illustrated. Kinki Coleopterological Society, Hoikusha, Osaka. [In Japanese.]

Neave, S. A. 1940. *Nomenclator Zoologicus* **3:** 1065 pp. London.

Nolan, E. J. 1913. *An index to the scientific contents of the Journal and Proceedings of the Academy of Natural Sciences of Philadelphia.* xiv + 1419 pp. Philadelphia.

Ohira, H. 1958. Studies on some *Melanotus* larvae from Japan (Coleoptera, Elateridae). *Japanese Journal of Applied Entomology and Zoology* **2:** 67–77, 3 pls. [In Japanese with English summary and key.]

—— 1962(viii). *Morphological and taxonomic study on the larvae of Elateridae in Japan (Coleoptera)*, 179 pp., 61 pls.Japan. Privately published by the author. [Text in Japanese, key, list of species, summary and plate captions in English.]

—— 1962(ix). New or little-known Elateridae from Japan, III (Coleoptera). *Kontyu* **30:** 198–201.

—— 1966. Notes on some Elateridae-beetles from Formosa III. *Kontyu* **34:** 331–338.

—— 1967. The Elateridae of the Ryukyu Archipelago, III (Coleoptera). *Bulletin of the Japan Entomological Academy* **3**(5): [27]–38.

—— 1968. Notes on some Elaterid beetles from Formosa, V. *Kontyu* **36:** 363–368.

—— 1970(ii)a. New or little-known Elateridae from Japan, XII (Coleoptera). *Bulletin of the Japan Entomological Academy* **5:** 9–13.

—— 1970[month unknown]b. A list of Elaterid-beetles from South Asia preserved in the Hungarian Natural History Museum (Coleoptera). Parts I–V. *Annales Historico-Naturales Musei Nationalis Hungarici* **62**, Pars Zoologica: 207–243.

—— 1973(iv). Notes on some Elaterid-beetles from Japan (Coleoptera) (XVII). *New Entomologist* **22:** 21–23. [In Japanese with English summary.]

—— 1973(v). Elaterid beetles from Borneo in the Bishop Museum (Coleoptera). *Pacific Insects* **15:** 103–137.

—— 1973(xii). Elateridae (Coleoptera) from the Natural History Survey of the Philippines by the Osaka Mus. Nat. Hist. and the Nat. Mus. of the Philippines in 1969. *Bulletin of the Osaka Museum of Natural History* no. 27: 1–10, 1 pl.

—— 1974. Notes on some Elaterid-beetles from Japan (XXI). *Kontyu* **42:** 351–357.

Ohira, H. & Arimoto, H. 1985. On the larva of *Melanotus* (*Spheniscosomus*) *restrictus* Candèze, 1865. *Gensei* **47:** 1–2, figs.[In Japanese.]

Ohira, H. & Becker, E. 1974. Elateridae (Coleoptera) from the Canadian Nepal Expedition. *Oriental Insects* **8:** 557–568.

Ohira, H. & Yasuda, N. 1984. Notes on *Melanotus ocellatopunctatus* Lewis, 1984 [sic, error for 1894]. *Bulletin of the Sounkyo Museum of Natural History* no. 4: 13–18.

Olivier, G. A. 1790. *Entomologie, ou histoire naturelle des insectes, Coléoptères* **2** (31): 54 pp., 8 pls. Paris.

Pankhurst, R. J. 1978. *Biological Identification.* viii + 104 pp. London. [Preparation of a new edition is in progress.]

—— 1986. A package of computer programs for handling taxonomic databases. *Computer Applications in the Biosciences* **2:** 33–39.

Platia, G. 1986. Due nuovi generi e cinque nuove specie della sottofamiglia Melanotinae Candèze della fauna Indomalese (Col. Elateridae). *Acta Coleopterologica* **2:** 1–8.

—— 1987. Nota di Omonimia (Coleoptera, Elateridae, Melanotinae). *Acta Coleopterologica* **2:** 34.

Quate, L. W. & Thomson, S. E. 1967. Revision of Click beetles of the genus *Melanotus* in America North of Mexico (Coleoptera, Elateridae). *Proceedings of the United States National Museum* **121** (3568): 83 pp., 1 pl

Redtenbacher, L. 1849. *Fauna Austriaca.* xxvii + 883 pp. Wien.

—— 1858. *Fauna Austriaca*, edn. 2: cxxvi + 1017 pp., 1 pl. Wien.

Reh, L. 1912. *In* Sorauer, *Handbuch der Pflanzenkrankheiten* edn 3. **3.** Die Tierischen Feinde. Elateriden pp. 479–483.

[The work appeared in parts; pp. 476–482 appeared in March 1911 and pp. 483–496 in May 1912.]

Reshetnyak, V. V. 1981. *Fauna SSSR* (N.S.) **123**, Akantarii (Acanthariea, Protozoa) mirovogo Okeaina [Acanthariea (Acanthariea, Protozoa) of the World Oceans.] 221 + [2] pp., [1] leaf of coloured plates. Leningrad. [In Russian.]

Riley, T. J. & Keaster, A. J. 1979. Wireworms associated with corn. Identification of nine species of *Melanotus* from the North Central States. *Annals of the Entomological Society of America* **72:** 408–414.

—— 1984. Wireworm (Coleoptera: Elateridae) larvae associated with bovine manure pats in a grazed pasture. *Journal of the Kansas Entomological Society* **57:** 357–359.

Rudolph, K. 1974. Beiträge zur Kenntnis der Elateridenlarven der Fauna der DDR und der BRD. (Eine Morphologisch-taxonomische Studie). *Zoologische Jahrbücher; Abteilung für Systematik* **101:** 1–115.

Sakurai, K. 1942. On the wireworms injurious to agricultural and horticultural plants in Hokkaido. *Kontyu* **16:** 1–11. [In Japanese except for generic and specific names and some references.]

Say, T. 1825. Descriptions of new American species of the genera *Buprestis*, *Trachys* and *Elater*. *Annals of the Lyceum of Natural History of New York* **1:** 249–268.

—— 1839. Descriptions of North American insects, and observations on some already described. *Transactions of the American Philosophical Society* (N.S.) **6:** 155–190.

[The Schenkling catalogue (1925–7) records the date of publication of the *Elater* species described on pp. 165–185 as 1836. The paper was read on June 17, 1836 but there is no doubt that the Transactions were not published until 1839.

It is possible that the descriptions had previously appeared in another publication (see Hayek, 1973: 294) but so far it has not proved possible to confirm this.]

Schenkling, S. 1925. *Coleopterorum Catalogus auspiciis et auxilio W. Junk*, Pars 80, Elateridae **1:** [1] + 263 pp. Berlin.

—— 1927. *Coleopterorum Catalogus auspiciis et auxilio W. Junk.*, Pars 88, Elateridae **2:** [265] + 636 pp. Berlin.

Schwarz, O. 1892(iii). Neue *Melanotus* von der paläarktischen Zone. *Deutsche Entomologische Zeitschrift* **1891**(2): 365–366.

[The date of publication of this paper has generally been cited as 1891, but a note on the title page states that heft 2 was published in March, 1892.]

—— 1892(iv). *Spheniscosomus*, eine neue, bisher Verkannte Elateriden-Gattung. *Wiener Entomologische Zeitung* **11:** 132.

—— 1892(viii). Revision der paläarktischen Arten der Elateriden-Gattung *Melanotus* Eschsch. *Deutsche Entomologische Zeitschrift* **1892:** 145–164, 1 pl. (no. 2).

—— 1901. Neue exotische Elateriden. *Deutsche Entomologische Zeitschrift* **1900**(2): 305–358.

[The date of publication of this paper has generally been cited as 1900, but a note on the title page states that heft 2 was published in February, 1901.]

—— 1902(i)a. *Cremnostethus* und *Metriaulacus* nov. gen Elateridarum. Ein Beitrag zur Kentniss der Elateriden-Gattung *Melanotus*. *Deutsche Entomologische Zeitschrift* **1901**(2): 197–199.

[The date of publication of this work is generally cited as 1901 but the footnote on p. 193 indicates that it appeared in heft 2 (pp. 161–376) of the journal which, according to a note on the title page, was published in January, 1902.]

—— 1902(i)b. Neue Elateriden. *Deutsche Entomologische Zeitschrift* **1901**(2): 311–336.

[Heft 2 was published in January 1902, see above.]

—— 1902(vii). Neue Elateriden. *Stettiner Entomologische Zeitung* **2:** 194–316.

—— 1902(x). Neue Elateriden aus dem tropischen Asien, der malayischen Inseln und den Inseln der Südsee. *Deutsche Entomologische Zeitschrift* **1902:** 305–350.

—— 1906. *In* Wytsman, *Genera Insectorum*. Fascicles **46A** & **46B** [1] + 224 pp., Bruxelles.

—— 1907. *In* Wytsman, *Genera Insectorum*. Fascicle **46C:** 225–370, 6 pls., Bruxelles.

Sharp, D. 1894. *Zoological Record* **31**. Insecta 384 pp. London.

Sherborn, C. D. & Griffin, F. J. 1934. On the dates of publication of the natural history portions of Alcide d'Orbigny's 'Voyage Amérique méridionale'. *Annals and Magazine of Natural History* (10) **17:** 130–134.

Smith, J. W. & Enns, W. R. 1978. The Click beetle families Agrypninae, Pyrophorinae and Melanotinae (Coleoptera, Elateridae) in Missouri – Part 2. *Journal of the Kansas Entomological Society* **51:** 42–74.

Smith, J. W. & Balsbaugh, E. U. 1984. A taxonomic revision of the Nearctic species of *Glyphonyx* (Coleoptera: Elateridae) with notes on *G. quadricollis* Champion. *North Dakota Insects, Schafer-Post series* no. 16: 86 pp., 70 figs.

Stephens, J. F. 1829. *A systematic catalogue of British insects*. [iii] + xxiv + 388 pp. London.

—— 1830. *Illustrations of British Entomology*; Mandibulata, **3:** 374 + [6] pp., 4 pls (nos. 14–19). London.

Stibick, J. N. L. 1976. A revision of the Hypnoidinae of the world. *Eos, Revista Española de Entomologia* **51:** 153–223.

—— 1979(iii). A revision of the Hypnoidinae of the world. Part III. The Hypnoidinae of Eurasia. *Eos, Revista Española de Entomologia* **53:** 223–307.

—— 1979(v). Classification of the Elateridae (Coleoptera). Relationships and classification of the subfamilies and tribes. *Pacific Insects* **20:** 145–186.

Stork, N. E. 1987. Adaptations of arboreal Carabids to life in trees. *Acta Phytopathologica Entomologica et Hungarica* **22:** 237–291.

Suzuki, W. 1978. Notes on Elaterid beetles from Taiwan, 1. The genus *Thaumastiellus*. *Kontyu* **46:** 439–444.

Szombathy, [K]. 1910(vii). Elatérides nouveaux ou peu connus appartenant au Musée National Hongrois. *Annales Historico-Naturales Musei Nationalis Hungarici* **8:** [353]–360.

—— 1910(xii). Elatérides nouveaux ou peu connus appartenantau Musée National Hongrois. *Annales Historico-Naturales Musei Nationalis Hungarici* **8:** [445]–448.

Thomas, C. A. 1941. The Elateridae of Pennsylvania. *Journal of the New York Entomological Society* **48:** 234–263.

Thomson, C. G. 1859. *Skandinaviens Coleoptera*. **1:** 304 pp. Lund.

Van Dyke, E. C. 1932. Miscellaneous studies in the Elateridae and related families of Coleoptera. *Proceedings of the California Academy of Sciences* (4) **20:** 291–465.

Van Zwaluwenburg, R. H. 1922. External anatomy of the Elaterid genus *Melanotus* (Coleop.) with remarks on the taxonomic value of certain characters. *Proceedings of the Entomological Society of Washington* **24:** 12–29.

—— 1933. New Elateridae (Col.) from Melanesia. *Stylops* **2:** 176–185.

—— 1934. New records and new species of Elaterid beetles from Melanesia. *Annals and Magazine of Natural History* (10) **13:** 591–597.

—— 1940. New species and new records of Elaterid beetles from the Pacific. *Occasional Papers of the Bernice P. Bishop Museum* **16:** 91–13.

—— 1948. New species and new records of Elaterid beetles from the Pacific–III. *Proceedings of the Hawaiian Entomological Society* **13:** 265–276, 6 figs.

—— 1957. Coleoptera: Elateridae. *Insects of Micronesia* **16:** 1–66, 1 map.

—— 1959. Some type designations, with notes on Pacific Elateridae. *Pacific Insects* **1:** 347–414, 2 pls.

—— 1963. Some Elateridae from the Papuan region. *Nova Guinea, Zoology* **16:** 303–346.

Vinson, J, 1960. Catalogue of the Coleoptera of Mauritius and Rodriguez. Part 3. Elateridae. *The Mauritius Institute Bulletin* **4:** 143–153.

Walker, F. 1858. Characters of some apparently undescribed Ceylon insects. *The Annals and Magazine of Natural History* (3) **11:** 280–286.

Waterhouse, C. O. 1906. *In* [Lankester, E. R., director and author of preface to volume **1**], *The history of the collections contained in the Natural History Departments of the British Museum* **2:** 579–601. *Alphabetical list of previous owners of collections of insects which contained types when acquired by the Museum; etc.*

Watson, L. 1984. Practical aspects of using Delta. *In* Dallwitz, M. J., User's guide to the DELTA system. A general system for coding taxonomic descriptions. *Report no. 13, edn 2. CSIRO Division of Entomology. Canberra*: 90–93.

Westwood, J. O. 1838. *An introduction to the modern classification of insects*. **2**, Synopsis. Coleoptera, pp. 1–44 (sheets B–D4). London.

[For the date of publication see Griffin, 1932(iii).]

Yacobson, G. G. 1913. *Beetles of Russia and Western Europe*. Elateridae, pp. 732–765. St. Petersburg.

[The work, consisting of 1024 pp., was published in parts between 1905 and 1915. For the dates of publication of the parts see Griffin, 1932(v).]

Zacharuk, R. Y. 1958. Structures and functions of the reproductive systems of the prairie grain wireworm, *Ctenicera aeripennis destructor* (Brown) (Coleoptera: Elateridae). *Canadian Journal of Zoology* **36:** 725–750, 32 figs.

Zimsen, E. 1964. *The type material of I. C. Fabricius*. 656 pp., 2 pls. Copenhagen.

In addition to the *Times Index-Gazetteer of the World*, London, 1965 the following gazetteers have been consulted in the course of this work.

Atlas des Colonies Franc,aises, publié sous la direction de G. Grandier. Société d'Editions Géographique, Maritimes et Coloniales. Paris. 1934.

Lippincott's Gazetteer of the World. Philadelphia, 1886.

Lippincott's Gazetteer of the World. Philadelphia & London, 1922.

Longmans' Gazetteer of the World. London, 1895.

Stieler's Hand-Atlas, Namenverzeichnis. Gotha, 1925.

Gazetteers. U.S. Navy Department, Hydrographic Office. U.S. Board of Geographic Names. *Gazetteers* prepared in the Office of the Geography Department of the Interior, Washington.

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Palaearctic Entomology
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Bulletin British Museum (Natural History)
ENTOMOLOGY SERIES
Vol. 59, No. 1, June 1990